PATENT ABSTRACTS OF JAPAN

(11)Publication number : 2005-277363

(43)Date of publication of application : 06.10.2005

(51)Int.Cl. H01L 21/027

(21)Application number : 2004-151714

(22)Date of filing : 21.05.2004

(71)Applicant : NIKON CORP

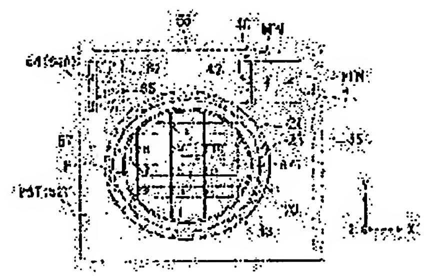
(72)Inventor : KOBAYASHI NAOYUKI
TANIMOTO SHOICHI
MIZUNO YASUSHI
SHIRAISHI KENICHI
NAKANO KATSUSHI
YAMATO SOICHI

(30)Priority

Priority number	Priority date	Priority country
2003146423	23.05.2003	JP
2003305280	28.08.2003	JP
2004049231	25.02.2004	JP

(54) EXPOSURE DEVICE AND DEVICE MANUFACTURING METHOD

(57)Abstract:
PROBLEM TO BE SOLVED: To provide an exposure device which can form a desired device pattern on a substrate by removing an unnecessary liquid, when exposing a pattern on the substrate via a projection optical system and the liquid.
SOLUTION: The exposure device exposes the substrate by projecting an image of the pattern on the substrate via the projection optical system and the liquid, and prepares a liquid-removing mechanism removing the liquid left on a part, arranged near the image of the projection optical system.



LEGAL STATUS

[Date of request for examination] 26.03.2007

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

CLAIMS

[Claim(s)]
[Claim 1]
In the aligner which projects the image of a pattern on a substrate through projection optics and a liquid, and exposes said substrate,
The aligner characterized by having the liquid removal device in which the liquid which remained on the components arranged near the image surface of said projection optics is removed.
[Claim 2]
Said liquid removal device is an aligner according to claim 1 characterized by having the aspirator which attracts the liquid adhering to said component.
[Claim 3]
Said liquid removal device is an aligner according to claim 1 or 2 characterized by spraying a gas on said component.
[Claim 4]
Said component is the aligner of claim 1-3 characterized by including the components at the tip of said projection optics given in any 1 term.
[Claim 5]
It has further the liquid feeder style which supplies a liquid,
Said component is the aligner of claim 1-4 characterized by including the supply nozzle of said liquid feeder style given in any 1 term.
[Claim 6]
It has further the liquid recovery device in which liquids are collected,
Said component is the aligner of claim 1-5 characterized by including the recovery nozzle of said liquid recovery device given in any 1 term.
[Claim 7]
Said component is the aligner of claim 1-6 characterized by contacting a liquid during exposure of said substrate given in any 1 term.
[Claim 8]
The aligner of claim 1-7 characterized by including a movable stage further by the image surface side of said projection optics given in any 1 term.
[Claim 9]
Said component is an aligner according to claim 8 characterized by at least or including the components prepared in said stage. [said stage]
[Claim 10]
Said component is an aligner according to claim 9 characterized by including the measurement member prepared in said substrate stage.
[Claim 11]
Said component is an aligner according to claim 9 or 10 characterized by including the criteria member prepared in said substrate stage.
[Claim 12]
It has further the measurement system which has the superior lamella which has the light transmission section which penetrates the exposure light from said projection optics, and the light-receiving system which receives the light which passed the light transmission section of this superior lamella,
Said component is the aligner of claim 9-11 characterized by including the superior lamella of said measurement system given in any 1 term.
[Claim 13]
Said a part of liquid removal device [at least] is the aligner of claim 8-12 characterized by being prepared in said substrate stage given in any 1 term.
[Claim 14]
Said bill-of-materials side is the aligner of claim 1-13 characterized by being liquid repellance given in any 1 term.
[Claim 15]
Said liquid removal device is an aligner of 3-14 claim 1 and given in any 1 term characterized by moving the liquid which remains to the predetermined field of said bill-of-materials side to the outside of the predetermined field.
[Claim 16]
Said liquid removal device is an aligner of 3-15 claim 1 and given in any 1 term characterized by removing said liquid using a pure gas or a desiccation gas.
[Claim 17]
Said liquid removal device is an aligner according to claim 16 characterized by using pure nitrogen gas.
[Claim 18]
Said liquid removal device is the aligner of claim 1-17 characterized by performing liquid removal after washing said component given in any 1 term.

[Claim 19]
The aligner of claim 1-18 characterized by having further detection equipment which detects the condition of said bill-of-materials side given in any 1 term.
[Claim 20]
Said liquid removal device is the aligner of claim 1-19 characterized by removing the liquid which remained on the components arranged near the image surface of said projection optics before exposure or after exposure given in any 1 term.
[Claim 21]
Furthermore, the aligner of claim 1-20 characterized by having during exposure the liquid recovery device in which the liquids on a substrate are collected given in any 1 term.
[Claim 22]
Said liquid removal device is the aligner of claim 8-21 characterized by having the 1st liquid removal device in which the liquid which remained on the components prepared on said stage is removed, and the 2nd liquid removal device in which the liquid which remained at the tip of said projection optics is removed given in any 1 term.
[Claim 23]
Said liquid removal device is the aligner of claim 8-22 characterized by having the gas blasting nozzle which is prepared in said stage and blows off a gas from said stage toward the upper part given in any 1 term.
[Claim 24]
It has the control unit which controls said liquid removal device,
Said control unit is an aligner of claim 1-23 characterized by controlling said liquid removal device to perform liquid removal by the liquid removal device at the time of the unload of a substrate given in any 1 term.
[Claim 25]
Furthermore, the aligner according to claim 1 characterized by having an optical member in contact with the liquid of an immersion field, and a focal detection system, and for the light injected from said focal detection system penetrating an optical member and a liquid, and reaching a substrate.
[Claim 26]
Said liquid removal device is an aligner according to claim 1 characterized by the thing movable in the direction of a substrate side for which gas jet is carried out and it has the section.
[Claim 27]
Said liquid removal device is an aligner according to claim 1 characterized by being equipment equipped with the nozzle which injects said liquid and gas alternatively.
[Claim 28]
Furthermore, the aligner according to claim 27 characterized by having the liquid feeder style which supplies said liquid, and having the passage switching unit which switches the passage of the liquid from a liquid feeder style, and the gas from the nozzle of said liquid removal device.
[Claim 29]
Furthermore, the aligner according to claim 26 characterized by having said liquid receptacle member which carried out gas jet and was equipped with the nozzle, and the actuator made to face and move a liquid receptacle member to projection optics.
[Claim 30]
The aligner according to claim 26 characterized by having said system which carries out gas jet and applies forward or negative pressure to the section alternatively at a substrate.
[Claim 31]
In the aligner which exposes said substrate by forming an immersion field in the part on a substrate, and projecting the image of a pattern on said substrate through projection optics and a liquid,
Said substrate is held and it is a movable substrate stage,
The liquid feeder style which supplies a liquid in order to form said immersion field,
The 1st liquid recovery device in which the liquids on said substrate are collected,
The aligner characterized by having the 2nd liquid recovery device in which have recovery opening prepared in said substrate stage, and liquids are collected after exposure termination of said substrate.
[Claim 32]
The aligner according to claim 31 characterized by collecting liquids after exposure termination of said substrate using said both 1st and 2nd liquid recovery devices.
[Claim 33]
The aligner according to claim 31 or 32 characterized by performing liquid supply by said liquid feeder style, and liquid recovery by said 1st liquid recovery device to coincidence in order to form said immersion field during exposure of said substrate.
[Claim 34]
Said 2nd liquid recovery device is the aligner of claim 31-33 characterized by collecting the liquids which flowed out during exposure of said substrate on the outside of said substrate given in any 1 term.
[Claim 35]
Furthermore, the aligner of claim 31-34 characterized by having a different liquid removal device from said 1st and 2nd liquid recovery device given in any 1 term.
[Claim 36]
In the aligner which exposes said substrate by irradiating exposure light on a substrate through projection optics and a liquid,
The aligner characterized by having detection equipment which detects the surface state of the components arranged near the image surface side of said projection optics.
[Claim 37]
Said detection equipment is an aligner according to claim 36 characterized by detecting the foreign matter adhering to said bill-of-materials side.
[Claim 38]

Said bill-of-materials side is an aligner according to claim 36 or 37 characterized by the thing of said projection optics for which the optical element front face by the side of the image surface is included most.

[Claim 39]

Furthermore, it is the aligner of claim 36-38 which is equipped with the washing station which washes said bill-of-materials side, and the control unit which controls said washing station, and is characterized by said control unit operating a washing station according to the detection result of said detection equipment given in any 1 term.

[Claim 40]

The device manufacture approach characterized by using the aligner of claim 1 - claim 39 given in any 1 term.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Field of the Invention]
[0001]
This invention relates to the aligner and the device manufacture approach of exposing a pattern to a substrate through projection optics and a liquid.
[Background of the Invention]
[0002]
A semiconductor device and a liquid crystal display device are manufactured by the technique of the so-called photolithography which imprints the pattern formed on the mask on a photosensitive substrate. The aligner used at this photolithography process has the mask stage which supports a mask, and the substrate stage which supports a substrate, and it imprints the pattern of a mask to a substrate through projection optics, moving serially on a mask stage and a substrate stage. Since it corresponds to much more high integration of a device pattern in recent years, the further high resolution-ization of projection optics is desired. The resolution of projection optics becomes so high that the numerical aperture of projection optics is so large that the exposure wavelength to be used becomes short. Therefore, exposure wavelength used with an aligner is short-wavelength-ized every year, and the numerical aperture of projection optics is also increasing. And although the exposure wavelength of the current mainstream is 248nm of KrF excimer laser, no less than 193nm of the ArF excimer laser of short wavelength is being put further in practical use. Moreover, in case it exposes, the depth of focus (DOF) as well as resolution becomes important. Resolution R and the depth of focus delta are expressed with the following formulas, respectively.
R=k1 and lambda/NA -- (1)
delta=**k2 and lambda/NA 2 -- (2)
Here, the numerical aperture of projection optics, and k1 and k2 is [lambda of exposure wavelength and NA] process multipliers. (1) In order to raise resolution R, when exposure wavelength lambda is shortened and numerical aperture NA is enlarged from a formula and (2) types, it turns out that the depth of focus delta becomes narrow.
[0003]
When the depth of focus delta becomes narrow too much, it becomes difficult to make a substrate front face agree to the image surface of projection optics, and there is a possibility that the margins at the time of exposure actuation may run short. Then, the immersion method which considers as the approach of shortening exposure wavelength substantially and making the depth of focus large, for example, is indicated by the following patent reference 1 is proposed. This immersion method expands the depth of focus by about n times while it improves resolution using filling between the inferior surface of tongue of projection optics, and substrate front faces with liquids, such as water and an organic solvent, and the wavelength of the exposure light in the inside of a liquid being set to 1/n in air (n being usually 1.2 to about 1.6 at the refractive index of a liquid).
[Patent reference 1] International public presentation/[99th] No. 49504 pamphlet
[Description of the Invention]
[Problem(s) to be Solved by the Invention]
[0004]
By the way, the problem described below exists in the above-mentioned conventional technique.
[0005]
Although the aligner currently indicated by the above-mentioned patent reference 1 is the configuration of performing supply and recovery of a liquid as an immersion field is formed in the part on a substrate Since the unload of the substrate on a substrate stage is carried out and a new substrate is loaded, if it is in the condition that the liquids of an immersion field are not fully collected, after immersion exposure termination, for example, a substrate stage moves to a load unload location The liquid which remained for the tip, liquid supply nozzle, or recovery nozzle of projection optics (adhesion) may fall to the reflector for the interferometers of a stage, surrounding equipment, and a member, for example, the guide side of a stage, etc.
[0006]
Moreover, if the liquid remains to the optical element at the tip of projection optics, after this remaining liquid evaporates, it may leave the remains of adhesion (the so-called watermark) to the optical element at the tip of projection optics, and may have a bad influence on the pattern formed on a substrate in the case of the next exposure processing. Moreover, although it is possible to form an immersion field when using the base plane member and reference mark member which are arranged around the substrate on a substrate stage besides exposure processing, the liquids of those immersion fields cannot fully be collected, the remains of adhesion may remain on those members, or the liquid which remained on those members may disperse.
[0007]
This invention is made in view of such a situation, and in case a pattern is projected and exposed to a substrate through projection optics and a liquid, it aims at fully removing an unnecessary liquid and offering the device [pattern / desired / device] manufacture approach using the aligner which can be formed on a substrate, and this aligner.
[Means for Solving the Problem]

[0008]
In order to solve the above-mentioned technical problem, this invention has adopted the configuration of the following matched with drawing 1 shown in the gestalt of operation - drawing 27 . However, it does not pass over the sign with a parenthesis given to each element to instantiation of the element, and it does not limit each element.
[0009]
In the aligner which the aligner (EX) of this invention projects the image of a pattern on a substrate (P) through projection optics (PL) and a liquid (1), and exposes a substrate (P) It is characterized by having the liquid removal device (40, 60, 160, 174, 178, 180, 183, 251, 257) in which the liquid (1) which remained on the components (2, 7, 13, 14, 31, 32,151,152) arranged near the image surface of projection optics (PL) is removed.
[0010]
The components which are arranged near the image surface of projection optics according to this invention For example, the optical element at the tip of projection optics, the criteria member for positioning of a shot field, Generating of the remains of adhesion on fall of the liquid which remained, scattering, and these components (watermark) can be prevented by removing the unnecessary liquid which remained on one [at least] nozzle etc. among various sensors, the light transmission optical member, the liquid feeder style, and the recovery device by the liquid removal device. Therefore, a desired pattern can be formed with a sufficient precision on a substrate.
[0011]
By the aligner of this invention forming an immersion field (AR2) in the part on a substrate (P), and projecting the image of a pattern on a substrate (P) through projection optics (PL) and a liquid (1) A substrate (P) is held in the aligner which exposes a substrate (P). A movable substrate stage (PST), The liquid feeder style which supplies a liquid (1) in order to form an immersion field (AR2) (10), It is characterized by having the 1st liquid recovery device (30) in which the liquids (1) on a substrate (P) are collected, and the 2nd liquid recovery device (20) in which have recovery opening (23) prepared in the substrate stage (PST), and liquids (1) are collected after exposure termination of a substrate (P).
[0012]
According to this invention, generating of the remains of adhesion of the fall, scattering, or the residual liquid object of the liquid which remained can be prevented after immersion exposure termination by collecting the liquids of the immersion field on a substrate not only by the 1st liquid recovery device but by the 2nd liquid recovery device in which it has recovery opening on a stage. Therefore, it becomes possible to form a desired pattern with a sufficient precision on a substrate.
[0013]
The aligner (EX) of this invention is characterized by having detection equipment (100) which detects the surface state of the components (2,151,152 etc.) arranged near the image surface side of projection optics (PL) in the aligner which exposes a substrate (P) by irradiating exposure light (EL) on a substrate (P) through projection optics (PL) and a liquid (1).
[0014]
Since the surface state (****** [that foreign matters, such as a liquid, have adhered] etc.) of the components arranged near the image surface of projection optics is detectable using detection equipment according to this invention, according to the result, tailing of suitable treatment, for example, a bill-of-materials side, etc. can be performed.
[0015]
The device manufacture approach of this invention is characterized by using the aligner (EX) of the above-mentioned publication. According to this invention, the device which has the desired engine performance where generating of the remains of adhesion to the optical element near the image surface of an environmental variation or projection optics is suppressed can be manufactured.
[Effect of the Invention]
[0016]
the environmental variation resulting from fall of the liquid which remained by removing the unnecessary liquid which remained on the components arranged near the image surface of projection optics according to this invention, and equipment -- rusting -- etc. -- generating can be prevented. Generating of the remains of adhesion to this optical element (watermark) can be prevented by removing the liquid which remains to the optical element at the tip of projection optics especially. Therefore, it becomes possible to form a desired pattern with a sufficient precision on a substrate.
[Best Mode of Carrying Out the Invention]
[0017]
Hereafter, it explains, referring to a drawing about the operation gestalt of the aligner of this invention. Drawing 1 is the outline block diagram showing 1 operation gestalt of the aligner of this invention.
[0018]
<The operation gestalt of the aligner using the 1st and 2nd liquid stripper>
The mask stage MST where Aligner EX supports Mask M in drawing 1 The illumination-light study system IL which illuminates the mask M currently supported by the substrate stage PST which supports Substrate P, and the mask stage MST with the exposure light EL It has the control unit CONT which carries out generalization control of the actuation of the projection optics PL which carries out projection exposure of the image of the pattern of the mask M illuminated with the exposure light EL at the substrate P currently supported by the substrate stage PST, and the whole aligner EX.
[0019]
The aligner EX of this operation gestalt is an immersion aligner which applied the immersion method, in order to shorten exposure wavelength substantially, and to make the depth of focus large substantially, while improving resolution, and it is equipped with the liquid feeder style 10 which supplies a liquid 1 on Substrate P, and the liquid recovery device (the 1st liquid recovery device) 30 in which the liquids 1 on Substrate P are collected. Pure water is used for a liquid 1 in this operation gestalt. Aligner EX forms the immersion field AR 2 at least in the part on the substrate P which includes the projection field AR 1 of projection optics PL with the liquid 1 supplied from the liquid feeder style 10, while imprinting the pattern image of Mask M on Substrate P at least. Aligner EX fills a liquid 1 between the optical element 2 of the point of projection optics PL, and the front face (exposure side) of Substrate P, projects the pattern image of Mask M on Substrate P through the liquid 1 and projection optics PL between this projection optics PL and Substrate P, and,

specifically, exposes Substrate P.

[0020]

Here, with this operation gestalt, carrying out a synchronized drive for being suitable (hard flow), as an aligner EX, the case where the scanning aligner (the so-called scanning stepper) which exposes a mutually different pattern [in / for Mask M and Substrate P / a scanning direction (the predetermined direction)] formed in Mask M to Substrate P is used is made into an example, and it explains. Let the direction which is perpendicular to Y shaft orientations (non-scanning direction), the X-axis, and Y shaft orientations, and is [direction / of Mask M and Substrate P / of a synchronized drive / (a scanning direction, the predetermined direction)] in agreement with the optical axis AX of projection optics PL in the direction which intersects perpendicularly with X shaft orientations in X shaft orientations and a horizontal plane be Z shaft orientations into a horizontal plane in the following explanation. Moreover, let the directions of the circumference of the X-axis, a Y-axis, and the Z-axis be thetaX, thetaY, and theta Z direction, respectively. In addition, a "substrate" here contains the reticle the "mask" had the device pattern by which contraction projection is carried out formed on a substrate including what applied the resist on the semi-conductor wafer.

[0021]

The illumination-light study system IL illuminates the mask M currently supported by the mask stage MST with the exposure light EL, and has the adjustable field diaphragm which sets up the lighting field on the condensing lens which condenses the exposure light EL from an optical integrator and an optical integrator which equalizes the illuminance of the flux of light injected from the light source for exposure, and the light source for exposure, a relay lens system, and the mask M by the exposure light EL in the shape of a slit. The predetermined lighting field on Mask M is illuminated by the illumination-light study system IL with the exposure light EL of uniform illumination distribution. As an exposure light EL injected from the illumination-light study system IL, vacuum-ultraviolet light (VUV light), such as far-ultraviolet light (DUV light), such as the bright line (g line, h line, i line) of an ultraviolet area, KrF excimer laser light (wavelength of 248nm), etc. which are injected, for example from a mercury lamp, and ArF excimer laser light (wavelength of 193nm), F2 laser beam (wavelength of 157nm), etc. is used. ArF excimer laser light is used with this operation gestalt. As mentioned above, the liquid 1 in this operation gestalt can be penetrated, even if it is pure water and the exposure light EL is ArF excimer laser light. Moreover, pure water can also penetrate far-ultraviolet light (DUV light), such as the bright line (g line, h line, i line) of an ultraviolet area, and KrF excimer laser light (wavelength of 248nm).

[0022]

that to which a mask stage MST supports Mask M — it is -- the inside of a flat surface perpendicular to the optical axis AX of projection optics PL, i.e., XY flat surface, — two-dimensional -- minute to movable and theta Z direction -- it is pivotable. A mask stage MST is driven with the mask stage driving gears MSTD, such as a linear motor. The mask stage driving gear MSTD is controlled by the control unit CONT. The migration mirror 50 is formed on the mask stage MST. Moreover, the laser interferometer 51 is formed in the location which counters the migration mirror 50. The location of the two-dimensional direction of the mask M on a mask stage MST and an angle of rotation are measured on real time by the laser interferometer 51, and a measurement result is outputted to a control unit CONT. A control device CONT positions the mask M currently supported by the mask stage MST by driving the mask stage driving gear MSTD based on the measurement result of a laser interferometer 51.

[0023]

Projection optics PL carries out projection exposure of the pattern of Mask M for the predetermined projection scale factor beta at Substrate P, it consists of two or more optical elements containing the optical element (lens) 2 prepared in the point by the side of Substrate P, and these optical elements are supported by Lens-barrel PK. In this operation gestalt, the projection scale factor beta of projection optics PL is the contraction system of 1/4 or 1/5. In addition, any of unit systems and an expansion system are sufficient as projection optics PL. Moreover, the optical element 2 of the point of the projection optics PL of this operation gestalt is formed possible [attachment and detachment (exchange)] to Lens-barrel PK. Moreover, the optical element 2 of a point is exposed from Lens-barrel PK, and the liquid 1 of the immersion field AR 2 contacts an optical element 2. Thereby, the corrosion of the lens-barrel PK which consists of a metal etc. is prevented.

[0024]

The optical element 2 is formed with fluorite. since compatibility of fluorite with pure water is high -- liquid contact surface 2a of an optical element 2 -- a liquid 1 can be mostly stuck on the whole surface. That is, since he is trying for compatibility with liquid contact surface 2a of an optical element 2 to supply the high liquid(water) 1 in this operation gestalt, the high adhesion of liquid contact surface 2a of an optical element 2 and a liquid 1 is securable. In addition, an optical element 2 may be a quartz with high compatibility with water. Moreover, hydrophilization (lyophilic-izing) processing is performed to liquid contact surface 2a of an optical element 2, and you may make it raise compatibility with a liquid 1 more.

[0025]

Moreover, Aligner EX has the focal detection system 4. The focal detection system 4 has light-emitting part 4a and light sensing portion 4b, projects slant to detection light on a substrate P front face (exposure side) through a liquid 1 from light-emitting part 4a, and receives the reflected light by light sensing portion 4b. A control unit CONT detects the location (focal location) in Z shaft orientations of the substrate P front face to predetermined datum level based on the light-receiving result of light sensing portion 4b while controlling actuation of the focal detection system 4. Moreover, the focal detection system 4 can also search for the posture of the inclination direction of Substrate P by asking for each focal location in two or more each point which can be set on a substrate P front face. In addition, as a configuration of the focal detection system 4, what is indicated by JP,8-37149,A, for example can be used.

[0026]

The substrate stage PST is equipped with Z stage 52 which holds Substrate P through a substrate holder, X-Y stage 53 which supports Z stage 52, and the base 54 which supports X-Y stage 53 in support of Substrate P. The substrate stage PST is driven with the substrate stage driving gears PSTD, such as a linear motor. The substrate stage driving gear PSTD is controlled by the control unit CONT. In addition, it cannot be overemphasized that a Z stage and an X-Y stage may be prepared in one. By driving X-Y stage 53 of the substrate stage PST, the location (it is [the image surface of projection optics PL and] the location of an parallel direction substantially) in the XY direction of Substrate P is controlled.

[0027]
The migration mirror 55 is formed on the substrate stage PST (Z stage 52). Moreover, the laser interferometer 56 is formed in the location which counters the migration mirror 55. The location of the two-dimensional direction of the substrate P on the substrate stage PST and an angle of rotation are measured on real time by the laser interferometer 56, and a measurement result is outputted to a control unit CONT. A control device CONT performs positioning in X shaft orientations and Y shaft orientations of Substrate P which are supported by the substrate stage PST by driving X-Y stage 53 through the substrate stage driving gear PSTD based on the measurement result of a laser interferometer 56.
[0028]
Moreover, a control device CONT controls the location in the location (focal location) in Z shaft orientations of the substrate P currently held at Z stage 52 and thetaX, and the direction of thetaY by driving Z stage 52 of the substrate stage PST through the substrate stage driving gear PSTD. That is, Z stage 52 operates based on the command from a control unit CONT based on the detection result of the focal detection system 4, controls the focal location (Z location) and tilt angle of Substrate P, and doubles the front face (exposure side) of Substrate P with the image surface formed through projection optics PL and a liquid 1.
[0029]
On the substrate stage PST (Z stage 52), the auxiliary plate 57 is formed so that Substrate P may be surrounded. The auxiliary plate 57 has the front face of the substrate P held at the substrate holder, and the flat surface of the almost same height. Here, although an about 0.1-2mm clearance is between the edge of Substrate P, and the auxiliary plate 57, also when a liquid 1 hardly flows into the clearance with the surface tension of a liquid 1 and it exposes near the periphery of Substrate P, a liquid 1 can be held under projection optics PL with the auxiliary plate 57.
[0030]
Near the tip of projection optics PL, the substrate alignment system 5 which detects the reference mark prepared on the alignment mark on Substrate P or Z stage 52 is formed. Moreover, near the mask stage MST, the mask alignment system 6 which detects the reference mark prepared on Z stage 52 through Mask M and projection optics PL is formed. In addition, as a configuration of the substrate alignment system 5, what is indicated by JP,4-65603,A, for example can be used, and what is indicated by JP,7-176468,A can be used as a configuration of the mask alignment system 6.
[0031]
Near the substrate alignment system 5, the 1st liquid stripper 40 which removes the liquid 1 which remained to the criteria member which has said reference mark prepared in Z stage 52 is formed. Moreover, the 2nd liquid recovery system 20 which collects liquids 1 is formed in the substrate stage PST.
[0032]
It is what supplies the predetermined liquid 1 on Substrate P in order that the liquid feeder style 10 may form the immersion field AR 2. The 1st liquid feed zone 11 and the 2nd liquid feed zone 12 which can send out a liquid 1, The 1st supply nozzle 13 which has the feed hopper which supplies the liquid 1 which was connected to the 1st liquid feed zone 11 through supply pipe 11A which has passage, and was sent out from this 1st liquid feed zone 11 on Substrate P, It connected with the 2nd liquid feed zone 12 through supply pipe 12A which has passage, and has the 2nd supply nozzle 14 which has the feed hopper which supplies the liquid 1 sent out from this 2nd liquid feed zone 12 on Substrate P. The 1st and 2nd supply nozzles 13 and 14 contact the liquid 1 of the immersion field AR 2 during immersion exposure. The 1st and 2nd supply nozzles 13 and 14 approach the front face of Substrate P, are arranged, and are prepared in a mutually different location in the direction of a field of Substrate P. The 1st supply nozzle 13 of the liquid feeder style 10 is formed in scanning direction one side (-X side) to the projection field AR 1, and, specifically, the 2nd supply nozzle 14 is formed in the other side (+X side).
[0033]
Each of the 1st and 2nd liquid feed zones 11 and 12 is equipped with the tank which holds a liquid 1, the booster pump, etc., and supplies a liquid 1 on Substrate P through each of supply pipes 11A and 12A and the supply nozzles 13 and 14. Moreover, liquid supply actuation of the 1st and 2nd liquid feed zones 11 and 12 is controlled by the control unit CONT, and its control unit CONT becomes [, respectively] independent about the liquid amount of supply per [to the substrate P top by the 1st and 2nd liquid feed zones 11 and 12] unit time amount and is controllable. Moreover, each of the 1st and 2nd liquid feed zones 11 and 12 has the temperature-control device of a liquid 1, and supplies the 23-degree C almost same liquid 1 as the temperature in the chamber in which equipment is held on Substrate P.
[0034]
Moreover, as for the pure water (liquid) supplied from the liquid feed zones 11 and 12, it is desirable to consider as 99%/mm or more of permeability, and, as for TOC (total organic carbon) which shows the total amount of the carbon in an organic system compound among the carbon compounds which are dissolving into pure water in that case, it is desirable to hold down to less than 3ppb.
[0035]
The liquid recovery device (the 1st liquid recovery system) 30 collects the liquids 1 on Substrate P, and is equipped with the 1st and 2nd recovery nozzles 31 and 32 which have recovery opening arranged by approaching the front face of Substrate P, and the 1st and 2nd liquid stripping sections 33 and 34 connected to these 1st and 2nd recovery nozzles 31 and 32 through the recovery tubing 33A and 34A which has passage, respectively. The 1st and 2nd recovery nozzles 31 and 32 contact the liquid 1 of the immersion field AR 2 during immersion exposure. The 1st and 2nd liquid stripping sections 33 and 34 are equipped with aspirators, such as a vacuum pump, the tank which holds the collected liquid 1, and collect the liquids 1 on Substrate P through the 1st and 2nd recovery nozzles 31 and 32 and the recovery tubing 33A and 34A. Liquid recovery actuation of the 1st and 2nd liquid stripping sections 33 and 34 is controlled by the control unit CONT, and its control unit CONT is controllable in the amount of liquid recovery per unit time amount by the 1st and 2nd liquid stripping sections 33 and 34.
[0036]
Drawing 2 is the top view showing the outline configuration of the liquid feeder style 10 and the liquid recovery device 30. As shown in drawing 2 , the projection field AR 1 of projection optics PL is set up in the shape of [which makes a longitudinal direction Y shaft orientations (non-scanning direction)] a slit (the shape of a rectangle), and the immersion field AR 2 where the liquid 1 was filled is formed in the part on Substrate P so that the projection field AR 1 may be

included. And the 1st supply nozzle 13 of the liquid feeder style 10 for forming the immersion field AR 2 of the projection field AR 1 is formed in scanning direction one side (-X side) to the projection field AR 1, and the 2nd supply nozzle 14 is formed in the other side (+X side). Each of the 1st and 2nd supply nozzles 13 and 14 is formed in the shape of [which makes Y shaft orientations a longitudinal direction] a plane view straight line, and the feed hopper is prepared so that the front face of Substrate P may be turned to, and it is formed in the shape of [which makes Y shaft orientations a longitudinal direction] a slit. The liquid feeder style 10 supplies a liquid 1 to coincidence on both sides of the projection field AR 1 from the feed hopper of the 1st and 2nd supply nozzles 13 and 14.

[0037]

Each of the 1st and 2nd recovery nozzles 31 and 32 of the liquid recovery device 30 has recovery opening continuously formed in the shape of radii so that the front face of Substrate P might be turned to. And approximate circle annular recovery opening is formed of the 1st and 2nd recovery nozzles 31 and 32 arranged so that it may face mutually. the 1st and 2nd recovery nozzles 31 and 32 -- each recovery opening is arranged so that the 1st and 2nd supply nozzles 13 and 14 of the liquid feeder style 10 and the projection field AR 1 may be surrounded. Moreover, two or more batch members 35 are formed in the interior of recovery opening continuously formed so that the projection field AR 1 might be surrounded.

[0038]

The liquid 1 supplied on Substrate P from the feed hopper of the 1st and 2nd supply nozzles 13 and 14 is supplied so that it may get wet and spread between the lower limit side of the point (optical element 2) of projection optics PL, and Substrate P. Moreover, the liquids 1 supplied from the 1st and 2nd supply nozzles 13 and 14 are collected from recovery opening of the 1st and 2nd recovery nozzles 31 and 32.

[0039]

Drawing 3 is the outline top view which looked at Z stage 52 of the substrate stage PST from the upper part. rectangle-like Z stage 52 -- in two perpendicular side faces, the migration mirror 55 arranges mutually -- having -- **** -- Z stage 52 -- in the center, Substrate P is mostly held through the non-illustrated holder. As mentioned above, the auxiliary plate 57 which has the front face of Substrate P and the flat surface of the almost same height is formed in the perimeter of Substrate P. And the liquid absorption member 21 which constitutes some 2nd liquid recovery systems 20 which collect liquids 1 is formed in the perimeter of the auxiliary plate 57. The liquid absorption member 21 is an annular member which has predetermined width of face, and is arranged in the slot (recovery opening) 23 annularly formed on Z stage 52. The liquid absorption member 21 is constituted by foam, such as porous ceramics. Or the sponge which is foam as a formation ingredient of the liquid absorption member 21 may be used. Specified quantity maintenance of a liquid 1 is possible for the liquid absorption member 21 which consists of foam.

[0040]

Drawing 4 is the sectional view showing the 2nd liquid recovery system 20. The above-mentioned liquid absorption member 21 arranged in the slot (recovery opening) 23 where the 2nd liquid recovery system 20 was annularly formed on Z stage 52, The passage 22 which is formed in the Z stage 52 interior and follows a slot 23, and the duct 26 which was established in the Z stage 52 exterior and connected the end section to passage 22, It connected with the other end of a duct 26, and has the tank 27 formed in the Z stage 52 exterior, and the pump 29 which is the aspirator connected to this tank 27 through the bulb 28. Outflow way 27A is prepared in the tank 27, and a liquid 1 is discharged from specified quantity ******** outflow way 27A. And the liquid recovery system 20 drives a pump 29, and as it absorbs the liquid 1 collected by the liquid absorption member 21 on a tank 27, it brings it together in it.

[0041]

The criteria member 7 is formed in one corner of Z stage 52. Reference mark PFM detected by the substrate alignment system 5 and the substrate mark MFM detected by the mask alignment system 6 are formed in the criteria member 7 by position relation. Moreover, the front face of the criteria member 7 has become almost flat, and also plays a role of datum level of the focal detection system 4. In addition, the datum plane of the focal detection system 4 may be prepared on Z stage 52 independently [the criteria member 7]. Moreover, the criteria member 7 and the auxiliary plate 57 may be formed by one.

[0042]

And near the criteria member 7, the liquid absorption member 42 which constitutes a part of 1st liquid stripper 40 which removes the liquid 1 which remained to the criteria member 7 is formed on Z stage 52. Furthermore, the 2nd liquid stripper 60 which removes the liquid 1 which remained to the optical element 2 at the tip of projection optics PL or the lens-barrel PK near a tip is formed in another corner of Z stage 52.

[0043]

Next, the procedure which exposes the pattern of Mask M to Substrate P using the aligner EX mentioned above is explained, referring to the flow chart Fig. of drawing 26 .

[0044]

Before supplying a liquid 1 from the liquid feeder style 10, measurement processing is first performed in the condition that there is no liquid 1 on Substrate P. A control unit CONT moves X-Y stage 53, carrying out the monitor of the output of a laser interferometer 56 so that the optical axis AX of projection optics PL may advance along with the wavy line arrow head 43 of drawing 3 . In the middle of the migration, the substrate alignment system 5 detects two or more alignment marks (un-illustrating) currently formed on Substrate P according to the shot fields S1-S11, without minding a liquid 1 (step SA 1). In addition, it is stopped by X-Y stage 53 when the substrate alignment system 5 detects an alignment mark. Consequently, the positional information of each alignment mark within the system of coordinates specified by the laser interferometer 56 is measured. In addition, detection of the alignment mark by the substrate alignment system 5 may detect all the alignment marks on Substrate P, and is good to even detect the part.

[0045]

Moreover, it is detected, without the surface information on Substrate P minding a liquid 1 by the focal detection system 4 during migration of the X-Y stage 53 (step SA 2). detection of the surface information by the focal detection system 4 -- all shot field S1- on Substrate P -- it is carried out for every S11, and a detection result makes the location of the scanning direction (X shaft orientations) of Substrate P correspond, and is memorized by the control unit CONT. In addition, it is also good to perform detection of the surface information by the focal detection system 4 to some shot

fields.
[0046]
After detection of the alignment mark of Substrate P and detection of the surface information on Substrate P are completed, a control device CONT moves X-Y stage 53 so that the detection field of the substrate alignment system 5 may be positioned on the criteria member 7. The substrate alignment system 5 detects reference mark PFM on the criteria member 7, and measures the positional information of reference mark PFM within the system of coordinates specified by the laser interferometer 56 (step SA 3).
[0047]
It means that the physical relationship of reference mark PFM and two or more alignment marks on Substrate P, i.e., the physical relationship of reference mark PFM and two or more shot fields S1-S11 on Substrate P, was searched for by completion of detection processing of this reference mark PFM, respectively. Moreover, since reference mark PFM and reference mark MFM have a position relation, it means that the physical relationship of reference mark MFM within XY flat surface and two or more shot fields S1-S11 on Substrate P was determined, respectively.
[0048]
Moreover, a control unit CONT detects the surface information on the front face (datum level) of the criteria member 7 by the focal detection system 4 before detection of reference mark PFM by the substrate alignment system 5, or to the back (step SA 4). It means that the relation between criteria member 7 front face and a substrate P front face was called for by completion of detection processing of the front face of this criteria member 7.
[0049]
Next, a control device CONT moves X-Y stage 53 so that the mask alignment system 6 can detect reference mark MFM on the criteria member 7. In this condition, the point and the criteria member 7 of projection optics PL have countered with a natural thing. Here, a control unit CONT starts the supply and recovery of a liquid 1 by the liquid feeder style 10 and the liquid recovery device 30, fills between projection optics PL and the criteria members 7 with a liquid 1, and forms an immersion field. In addition, the magnitude of the XY direction of the criteria member 7 is fully larger than the supply nozzles 13 and 14 and the recovery nozzles 31 and 32, and the immersion field AR 2 is smoothly formed on the criteria member 7.
[0050]
Next, a control unit CONT detects reference mark MFM through Mask M, projection optics PL, and a liquid 1 by the mask alignment system 6 (step SA 5). It means that this minds projection optics PL and a liquid 1, and the location of the mask M within XY flat surface, i.e., the projection positional information of the image of the pattern of Mask M, was detected using reference mark MFM.
[0051]
After the above measurement processings are completed, a control unit CONT suspends supply actuation of the liquid 1 to the criteria member 7 top by the liquid feeder style 10. On the other hand, a control unit CONT carries out predetermined period continuation of the recovery actuation of the liquid 1 on the criteria member 7 by the liquid recovery device 30 (step SA 5.1). And after said predetermined period passes, a control unit CONT moves on the substrate stage PST, in order to remove the liquid 1 which remained on the criteria member 7, without the ability collecting by the liquid recovery device 30, while suspending the recovery actuation by the liquid recovery device 30.
[0052]
Drawing 5 is drawing showing signs that the 1st liquid stripper 40 which constitutes a part of liquid removal device has removed the liquid 1 which remained to the criteria member 7 prepared on the substrate stage PST (Z stage 52), drawing 5 (a) is an outline perspective view, and drawing 5 (b) is a sectional view. The 1st liquid stripper 40 is equipped with the blasting equipment 41 on which a gas is sprayed to the criteria member 7, and the liquid absorption member 42 which adjoined the criteria member 7 and was prepared in drawing 5 . Blasting equipment 41 is equipped with gas feed zone 41A which can send out a gas, and the nozzle section 43 connected to gas feed zone 41A. Diffuser 43A of the nozzle section 43 is formed in the shape of a slit, approaches the criteria member 7 and is arranged. And the liquid absorption member 42 is formed in diffuser 43A of the nozzle section 43, and the location which counters on both sides of the criteria member 7. Gas feed zone 41A and the nozzle section 43 are supported by the non-illustrated supporter with which projection optics PL became independent, and the liquid absorption member 42 is arranged in the slot 44 which is recovery opening prepared in Z stage 52. Like the liquid absorption member 21 of the 2nd liquid recovery system 20, the liquid absorption member 42 is constituted by foam, such as porous ceramics and sponge, and specified quantity maintenance of a liquid 1 is possible for it. By sending out a gas from gas feed zone 41A, a high-speed gas is sprayed on the criteria member 7 from across through diffuser 43A of the shape of a slit of the nozzle section 43. A control unit CONT blows away and removes the liquid 1 which remained on the criteria member 7 by spraying a gas from the nozzle section 43 of the 1st liquid stripper 40 to the criteria member 7 (step SA 5.2). At this time, a control device CONT can spray a gas on the whole front face of the criteria member 7 uniformly by spraying a gas on the criteria member 7 from the nozzle section 43, moving to the nozzle section 43 of the 1st liquid stripper 40 on the substrate stage PST (namely, criteria member 7). The blown-away liquid 1 is held at the liquid absorption member 42 arranged in diffuser 43A of the nozzle section 43, and the location which counters (recovery).
[0053]
As shown in drawing 5 (b), the passage 45 which follows a slot 44 is formed in the Z stage 52 interior, and the pars basilaris ossis occipitalis of the liquid absorption member 42 arranged in the slot 44 is connected to passage 45. The passage 45 connected to the slot 44 which has arranged the liquid absorption member 42 is connected to the end section of the duct 46 established in the Z stage 52 exterior. On the other hand, the other end of a duct 46 is connected to the pump 49 which is an aspirator through the tank 47 and bulb 48 which were prepared in the Z stage 52 exterior. Outflow way 47A is prepared in the tank 47, and a liquid 1 is discharged from specified quantity ******** outflow way 47A. And the 1st liquid stripper 40 drives a pump 49 while driving gas feed zone 41A, and as it absorbs the liquid 1 collected by the liquid absorption member 42 on a tank 47, it brings it together in it.
[0054]
Subsequently, in order to expose each shot fields S1-S11 on Substrate P, a control unit CONT moves X-Y stage 53, and makes projection optics PL and Substrate P counter (step SA 6). If projection optics PL and Substrate P are made to

counter, a control unit CONT will drive the liquid feeder style 10, and will start the liquid supply actuation to Substrate P top. After the liquid 1 sent out from each of the 1st and 2nd liquid feed zones 11 and 12 of the liquid feeder style 10 in order to form the immersion field AR 2 circulates supply pipes 11A and 12A, it is supplied on Substrate P through the 1st and 2nd supply nozzles 13 and 14, and forms the immersion field AR 2 between projection optics PL and Substrate P. At this time, the feed hopper of the 1st and 2nd supply nozzles 13 and 14 is arranged at X shaft-orientations (scanning direction) both sides of the projection field AR 1, and a control unit CONT supplies the liquid 1 to Substrate P top to coincidence on both sides of the projection field AR 1 from the feed hopper of the liquid feeder style 10. Thereby, the liquid 1 supplied on Substrate P forms the immersion field AR 2 of the range [at least] larger than the projection field AR 1 on Substrate P. Moreover, a control unit CONT controls the 1st and 2nd liquid stripping sections 33 and 34 of the liquid recovery device 30, and performs liquid recovery actuation on Substrate P in parallel to supply actuation of the liquid 1 by the liquid feeder style 10. That is, in order that a control unit CONT may form the immersion field AR 2 during exposure of Substrate P, liquid supply by the liquid feeder style 10 and liquid recovery by the liquid recovery device (the 1st liquid recovery device) 30 are performed to coincidence (step SA 7). Thereby, the liquids 1 on the substrate P which flows from the feed hopper of the 1st and 2nd supply nozzles 13 and 14 outside to the projection field AR 1 are collected from recovery opening of the 1st and 2nd recovery nozzles 31 and 32. Thus, the liquid recovery device 30 collects the liquids 1 on Substrate P with recovery opening prepared so that the projection field AR 1 may be surrounded.

[0055]

And scan exposure of each shot fields S1-S11 on Substrate P is carried out using each information searched for during the above-mentioned measurement processing (step SA 8). That is, during the scan exposure to each of each shot field, each shot fields S1-S11 on Substrate P and alignment with Mask M are performed based on the information on the physical relationship of the reference mark PFM and each shot fields S1-S11 for which it asked before supply of a liquid 1, and the projection positional information of the image of the pattern of the mask M for which it asked using reference mark MFM after supply of a liquid 1.

[0056]

Moreover, the physical relationship of a substrate P front face and the image surface formed through a liquid 1 is adjusted during the scan exposure to each shot fields S1-S11, without using the focal detection system 4 based on the surface information on the substrate P for which it asked before supply of a liquid 1, and the field information on the substrate P front face detected using the focal detection system 4 during scan exposure.

[0057]

In this operation gestalt, in case a liquid 1 is supplied from the scanning direction both sides of the projection field AR 1 to Substrate P, a control unit CONT controls liquid supply actuation of the 1st and 2nd liquid feed zones 11 and 12 of the liquid feeder style 10, and sets up it about a scanning direction. [than the liquid amount of supply which supplies the liquid amount of supply per / which is supplied from this side of the projection field AR 1 / unit time amount in the opposite side] [more] When carrying out exposure processing, moving Substrate P in the direction of +X, for example, a control unit CONT As opposed to the projection field AR 1 the amount of liquids from the -X side (namely, the 1st supply nozzle 13) + Make [more] it than the amount of liquids from the X side (namely, the 2nd supply nozzle 14), and on the other hand, when carrying out exposure processing, moving Substrate P in the direction of -X, make [more] the amount of liquids from the +X side to the projection field AR 1 than the amount of liquids from the -X side.

[0058]

After scan exposure of each shot fields S1-S11 on Substrate P is completed, a control unit CONT moves on the substrate stage PST so that the recovery opening 23 of the 2nd liquid recovery system 20 prepared in the substrate stage PST may counter with projection optics PL, while suspending the liquid supply by the liquid feeder style 10. And a control unit CONT uses together the liquid recovery device (the 1st liquid recovery system) 30 and the 2nd liquid recovery system 20, and the liquids 1 currently formed in the bottom of projection optics PL are collected (step SA 9). Thus, since he is trying for the liquid recovery device (the 1st liquid recovery system) 30 in which recovery opening is arranged above the substrate stage PST, and the 2nd liquid recovery system 20, with which recovery opening is arranged on the substrate stage PST to recover the liquid 1 of the immersion field AR 2 to coincidence, it can reduce that a liquid 1 remains on the tip of projection optics PL, or Substrate P.

[0059]

In addition, although the 2nd liquid recovery system 20 collects the liquids 1 of the immersion field AR 2 after exposure termination of Substrate P, you may make it collect the liquids 1 which flowed out during immersion exposure on the outside of Substrate P (auxiliary plate 57). Moreover, although the recovery opening 23 of the 2nd liquid recovery system 20 is formed in the surroundings of Substrate P in the shape of zona orbicularis (circular ring), you may make it prepare it in the predetermined location near the substrate P (auxiliary plate 57) partially in consideration of the migration direction of the substrate stage PST after exposure termination of Substrate P. Moreover, in immersion exposure order, since it approves even if the vibration accompanying recovery actuation becomes large, recovery power of the liquid recovery device 30 may be made larger than under immersion exposure.

[0060]

Moreover, although Substrates P are not components, it specifically arranges under said blasting equipment 41, and a gas sprays on Substrate P and it may make collect the location which moved on the substrate stage PST which supported this substrate P, and is distant from projection optics PL in Substrate P, and the blown-away liquids 1 with the 2nd liquid recovery system 20 after immersion exposure termination, when the liquids 1 on Substrate P cannot be collected. Of course, this gas blasting actuation can also be performed only to Substrate P to Z stage 52 front face of auxiliary plate 57 and auxiliary plate 57 outside.

[0061]

That is, although the 1st liquid stripper 40 removes the liquid 1 which remains on the criteria member 7, it is also possible to remove the liquid 1 which remained on components other than criteria member 7 on the substrate stage PST. For example, a liquid 1 flows out or disperses during immersion exposure on the outside of Substrate P, and when it is in the condition that the liquid 1 has been arranged on the substrate stage PST (Z stage 52), the liquids 1 on this substrate stage PST can be collected by the 1st liquid stripper 40 after exposure termination of Substrate P. In this case, the liquids 1 blown away with the blasting equipment 41 of the 1st liquid stripper 40 may be collected by the liquid absorption

member 21 arranged in the slot (recovery opening) 23 of the 2nd liquid recovery system 20.
[0062]
Moreover, the nozzle section 43 of blasting equipment 41 is formed movable to the substrate stage PST, and it may be made to collect the liquids 1 which flowed into the outside of Substrate P the inside of exposure of Substrate P, and after exposure termination.
[0063]
Since the 1st liquid stripper 40 which removes the liquid 1 which remained on the criteria member 7 prepared in the substrate stage PST (Z stage 52) was formed as explained above, survival of the liquid 1 on the criteria member 7 can be prevented. Moreover, since liquids 1 were collected after exposure termination of Substrate P also using recovery opening on the substrate stage PST, survival of the tip of projection optics PL and a nozzle or the liquid 1 on Substrate P can be prevented, and fall and scattering of a liquid 1 can be prevented.
[0064]
In addition, in an above-mentioned operation gestalt, although the 1st liquid stripper 40 has the liquid absorption member 42 arranged near the criteria member 7, the liquid absorption member 42 may be omitted. In this case, the liquid 1 removed from on the criteria member 7 can also make the predetermined field on the substrate stage PST which has effect neither in exposure actuation nor measurement actuation remain.
[0065]
Drawing 6 is drawing showing other operation gestalten of the 1st liquid stripper 40. the sign same about a component the same as that of the operation gestalt mentioned above in the following explanation or equivalent is attached, and simple in the explanation — or it omits. The 1st liquid stripper 40 is equipped with the aspirator 81 which attracts the liquid 1 which has adhered on the criteria member 7 in drawing 6 . The aspirator 81 is equipped with suction section 81A containing a tank and a pump, and the suction nozzle 82 connected to suction section 81A. And suction opening 82A of the suction nozzle 82 approaches the criteria member 7, and is arranged. In case the liquid 1 which remained on the criteria member 7 is removed, while blasting equipment 41 sprays a gas to the criteria member 7, an aspirator 81 attracts the liquid 1 on the criteria member 7.
[0066]
In addition, although blasting equipment 41 and an aspirator 81 are put side by side to the 1st liquid stripper 40 in the example explained with reference to drawing 6 , you may be the configuration that only the aspirator 81 is formed. An aspirator 81 is attracting the liquid 1 which remains on the criteria member 7, and can remove this liquid 1 from absorption opening 82A (recovery). In addition, the nozzle section 82 of an aspirator 81 is formed movable to the substrate stage PST, and you may make it collect the liquids 1 which flowed into the outside of Substrate P the inside of exposure of Substrate P, and after exposure termination.
[0067]
Moreover, also in the operation gestalt of drawing 6 , although the 1st liquid stripper 40 has the liquid absorption member 42 arranged near the criteria member 7, the liquid absorption member 42 may be omitted.
[0068]
Drawing 7 is the sectional view showing other operation gestalten of the 1st liquid stripper 40. As shown in drawing 7 , the 1st liquid stripper 40 is equipped with the desiccation gas feed zone 85 which supplies a desiccation gas for the criteria member 7 to the building envelope of the wrap (arranged above criteria member 7) covering member 84, and the covering member 84. The desiccation gas feed zone 85 supplies a desiccation gas to the building envelope of the covering member 84 where the criteria member 7 is arranged through a duct 86. By carrying out like this, evaporation of the liquid 1 which remained to the criteria member 7 is promoted, and a liquid 1 is removed.
[0069]
In addition, although he is trying for the 1st liquid stripper 40 to remove the liquid of components, such as the criteria member 7 carried in the substrate stage PST, when the stage where Aligner EX was equipped with a measurement member or the reference section apart from the substrate stage PST is carried as indicated by JP,11-135400,A, it can also remove the liquid of the components on the stage.
[0070]
Next, the 2nd liquid stripper 60 which removes the liquid 1 which remained to the optical element 2 at the tip of projection optics PL or the lens-barrel PK near a tip is explained, referring to drawing 8 . The 2nd liquid stripper 60 is equipped with the recovery system (aspirator) 62 which collects the blasting equipment 61 on which a gas is sprayed to the optical element 2 which constitutes the components at the tip of projection optics PL, or the lens-barrel PK of the near, and the liquids which remained at the tip of projection optics PL, were blown away by gas blasting by blasting equipment 61, and fell in drawing 8 . Blasting equipment 61 is equipped with the gas feed zone 63 and the nozzle section 64 which is connected to the gas feed zone 63 and prepared in crevice 64B of Z stage 52, and diffuser 64A of the nozzle section 64 is turned up, and it can arrange it near the tip of projection optics PL. The recovery opening 65 with which the recovery system 62 was formed in Z stage 52 on the other hand (slot), The liquid absorption member 66 which consists of foam arranged at the recovery opening 65, and the passage 67 which is formed in the Z stage 52 interior and follows a slot 66, It was prepared in the Z stage 52 exterior, and it connected with the other end of the duct 68 which connected that end section to passage 67, and a duct 68, and has the tank 69 formed in the Z stage 52 exterior, and the pump 71 which is the aspirator connected to this tank 69 through the bulb 70. Outflow way 69A is prepared in the tank 69, and a liquid 1 is discharged from specified quantity ******** outflow way 69A. And a recovery system 62 drives a pump 71, and as it absorbs the liquid 1 collected by the liquid absorption member 66 on a tank 69, it brings it together in it.
[0071]
In this operation gestalt, diffuser 64A of the nozzle section 64 of blasting equipment 61 has the shape of a slit which makes Y shaft orientations a longitudinal direction (refer to drawing 3), and the recovery opening 65 of a recovery system 62 is formed in the location which adjoins the +X side of diffuser 64A in the shape of [which makes Y shaft orientations a longitudinal direction] a rectangle. And the 2nd liquid stripper 60 performs not only the tip of the projection optics PL which contacted the liquid 1 of the immersion field AR 2 during exposure of Substrate P after exposure termination of Substrate P but removal of the liquid 1 which remained for the supply nozzles (components) 13 and 14 of the liquid feeder style 10, and the recovery nozzles (components) 31 and 32 of the liquid recovery device 30. Of course, the liquid of only

the tip of projection optics PL or a nozzle is removable.
[0072]
A control unit CONT collects the liquids 1 on Substrate P using the liquid recovery device (the 1st liquid recovery system) 30 after the immersion exposure termination to Substrate P (after the above-mentioned step SA8 termination) (step SA 9). And after recovery of the liquid 1 on the substrate P by the liquid recovery device 30 is completed, a control device CONT moves on the substrate stage PST, and arranges the 2nd liquid stripper 60 under projection optics PL. And the 2nd liquid stripper 60 is sprayed to the tip of projection optics PL, sprays a gas from across, and blows away and removes the liquid 1 which remained at the tip of this projection optics PL from the nozzle section 64 of equipment 61 (step SA 10). The blown-away liquid 1 falls and are collected by the recovery opening 65 which has arranged the liquid absorption member 66 of a recovery system 62. Here, a control device CONT drives the 2nd liquid stripper 60, moving the substrate stage PST to X shaft orientations which intersect perpendicularly with the longitudinal direction (Y shaft orientations) of diffuser 64A and the recovery opening 65. By carrying out like this, a gas can be sprayed also on the supply nozzles 13 and 14 of the liquid feeder style 10 arranged to the perimeter, and the recovery nozzles 31 and 32 of the liquid recovery device 30 as well as the tip of projection optics PL, and the liquid 1 which remains for these supply nozzles 13 and 14 and the recovery nozzles 31 and 32 can also be removed.
[0073]
By removing the liquid 1 which remained for the tip, the supply nozzles 13 and 14, and the recovery nozzles 31 and 32 of the projection optics PL in contact with the liquid 1 of the immersion field AR 2 under exposure, as explained above As shown in the mimetic diagram of drawing 9 , even if the substrate stage PST moves from under projection optics PL (exposure processing location A) to the location (load unload location B) which carries out the load unload of the substrate P Inconvenient generating of the liquid 1 which remained at the tip of said projection optics PL etc. falling, and affecting a peripheral device or bringing about an environmental variation can be suppressed. Generating of the remains of adhesion (watermark) can be controlled by not making a liquid 1 remain in the optical element 2 at the tip of projection optics PL especially.
[0074]
And if the 2nd liquid stripper 60 is driven moving by having formed the 2nd liquid stripper 60 in the substrate stage PST on the substrate stage PST, even if it does not form a new actuator, a gas can be sprayed, scanning the 2nd liquid stripper 60 to projection optics PL, a supply nozzle, and a recovery nozzle. Moreover, after immersion exposure termination, as shown, for example in drawing 9 , while moving from the exposure processing location A to the load unload location B, by being made to perform blasting actuation of the gas by the 2nd liquid stripper 60, liquid removal actuation (gas blasting actuation) and stage migration actuation can be performed to coincidence, and time amount effectiveness can be improved. Therefore, while the substrate stage PST moves from the exposure processing location A to the load unload location B, as for the 2nd liquid stripper 60, it is desirable to prepare in the location which passes through the bottom of projection optics PL beforehand.
[0075]
Drawing 10 and drawing 11 are the modifications of the 2nd liquid stripper 60. As shown in drawing 10 , the big slot 72 is formed on Z stage 52, and the nozzle section 64 of blasting equipment 61 and the passage (recovery opening) 67 of a recovery system 62 may be arranged in this slot 72. In addition, the liquid absorption member 66 is not formed in the example shown in drawing 10 . Thus, it is also possible to consider as the configuration which does not form the liquid absorption member 66. Moreover, as shown in drawing 11 , two or more (at the example shown in drawing 11 , it is two) nozzle sections 64 of blasting equipment 61 may be formed in a slot 72. Moreover, scattering to the perimeter of the liquid 1 on which the gas was sprayed can be controlled in a slot 72 by having formed the larger slot 72 than the tip of projection optics PL, and having arranged the nozzle section 64 and the recovery opening 67 in this like the example shown in drawing 10 and drawing 11 .
[0076]
Or as shown in drawing 12 , the covering member 73 for preventing scattering to the perimeter of the liquid 1 which had the gas sprayed on the surroundings of diffuser 64A of the nozzle section 64 and the recovery opening 65 can also be formed. The covering member 73 shown in drawing 12 is formed in the shape of [which can arrange the tip of projection optics PL] plane view of U characters, and the tip of projection optics PL goes in and out from a U character-like opening side to the covering member 73 interior. And liquid removal can be efficiently performed by making in agreement the longitudinal direction of this covering member 73 in the migration direction (X shaft orientations) of the substrate stage PST, and preparing diffuser 64A and the recovery opening 65 which make Y shaft orientations a longitudinal direction in this covering member 73 interior, preventing scattering of a liquid 1 by one scan migration.
[0077]
In addition, the liquid 1 which flowed out during exposure of Substrate P on the outside of Substrate P is also recoverable through the recovery opening 65 of the recovery system 62 of the 2nd liquid stripper 60. At this time, it is desirable to form two or more recovery openings 65 of a recovery system 62 in the perimeter of Substrate P at intervals of predetermined.
[0078]
Moreover, in the operation gestalt of drawing 8 - drawing 12 , although the 2nd liquid stripper 60 is equipped with the recovery system 62 near the nozzle section 64, it may omit this. In this case, the liquid 1 removed from the tip of projection optics PL can also make the predetermined field on the substrate stage PST which has effect neither in exposure actuation nor measurement actuation remain.
[0079]
Moreover, in the operation gestalt of drawing 8 - drawing 12 , although the 2nd liquid stripper 60 is arranged on the substrate stage PST, it may arrange the 2nd liquid stripper 60 to a different member from the substrate stage PST. For example, the movable stage is further carried for the image surface side of projection optics PL, and you may make it arrange the 2nd liquid stripper 60 independently on the stage with the substrate stage PST.
[0080]
Moreover, suction opening may be prepared near the diffuser 64A of the nozzle section 64 of projection optics PL, a supply nozzle, and the 2nd liquid stripper 60 of a recovery nozzle. Or suction opening is prepared instead of the diffuser

64A, and you may make it collect the liquids adhering to the apical surface of projection optics PL, a supply nozzle, and a recovery nozzle.

[0081]

By the way, even if it removes the liquid 1 at the tip of projection optics PL, the impurity and foreign matter which are contained in the liquid 1 may adhere to the optical element 2 at the tip of projection optics PL, and an optical element 2 may pollute. Here, with an impurity and a foreign matter, the fragment of a photoresist, the sludge of the electrolyte contained in a photoresist, etc. are mentioned. Then, it is desirable that a removal (it blows away and draws in) front stirrup washes this optical element 2 for the liquid 1 which remains to the optical element 2 at the tip of projection optics PL behind.

[0082]

Drawing 13 is the mimetic diagram showing the condition of washing the tip of projection optics PL. In the operation gestalt shown in drawing 13 , the washing station 90 is established in the location different from the substrate P held on the substrate stage PST (Z stage 52) at the substrate holder. The washing plate 91 is formed in the washing station 90. The washing plate 91 is a plate member which has the almost same magnitude for example, as the substrate P.

[0083]

In order to wash the optical element 2 at the tip of projection optics PL after immersion exposure termination (or before), a control device CONT moves on the substrate stage PST, and arranges the washing plate 91 (washing station 90) under projection optics PL. And a control unit CONT drives the liquid feeder style 10 and the liquid recovery device 30, and forms the immersion field AR 2 between projection optics PL and the washing plate 91. The optical element 2 at the tip of projection optics PL is washed by the liquid 1 of the immersion field AR 2 formed on this washing plate 91. And after washing processing is completed, as mentioned above, the liquid 1 which remained to the optical element 2 at the tip of projection optics PL is removed using the 2nd liquid stripper 60.

[0084]

In addition, although the immersion field AR 2 is formed on the washing plate 91 using the liquid feeder style 10 and the liquid recovery device 30 and the liquid 1 of this immersion field AR 2 is washing the optical element 2 at the tip of projection optics PL at the washing station 90 shown in drawing 13 , as shown in drawing 14 , it is possible to form the soaping-machine style 95 in the washing station 90, and to wash the optical element 2 at the tip of projection optics PL using this soaping-machine style 95. The soaping-machine style 95 of the washing station 90 shown in drawing 14 The injection section 97 which has injection-tip 97A which injects the liquid for washing which connected with the liquid feed zone 96 for washing, and the liquid feed zone 96 for washing, and was sent out from the liquid feed zone 96 for washing to the optical element 2 at the tip of projection optics PL, It connected with the recovery tubing 98 which has recovery opening 98A which collects the waste water after washing an optical element 2, and the recovery tubing 98, and has the stripping section 99 which consists of a pump, a tank, etc. Injection-tip 97A and recovery opening 98A are arranged in the slot 94 formed on the substrate stage PST (Z stage 52). The washing station 90 is arranged under projection optics PL after immersion exposure termination, and an optical element 2 is washed by injecting the liquid for washing to the optical element 2 at the tip of projection optics PL by the injection section 97 of the soaping-machine style 95. At this time, scattering to the perimeter of the liquid for washing is prevented by arranging injection-tip 97A and recovery opening 98A to a slot 94.

[0085]

Moreover, although the washing station 90 (washing plate 91) is arranged on the substrate stage PST, it may be arranged to a different member from the substrate stage PST. For example, the movable stage is further carried for the image surface side of projection optics PL, and you may make it arrange a washing station independently on the stage with the substrate stage PST.

[0086]

Moreover, it is desirable after washing actuation and liquid removal actuation to check whether the foreign matter has adhered to the optical element 2 at the tip of projection optics PL by the foreign matter detection system. Drawing 15 is the mimetic diagram showing an example of the foreign matter detection system 100. In addition, with a foreign matter here, the liquid (drop) 1 which remained is included besides the sludge of the electrolyte contained in the fragment of the photoresist mentioned above, or a photoresist etc.

[0087]

The light-emitting part 118 which the foreign matter detection system 100 is formed on the substrate stage PST (Z stage 52), and irradiates a predetermined exposure light from a slanting lower part to optical element 2 front face at the tip of projection optics PL in drawing 15 , The branching mirror 119 arranged on the optical path which connects optical element 2 front face and a light-emitting part 118, The 1st light sensing portion 120 for being prepared on the substrate stage PST and receiving the reflected light from optical element 2 front face based on the exposure from a light-emitting part 118, It has been arranged in the upper part location of the substrate stage PST, and has the 2nd light sensing portion 121 for receiving the branching light from the branching mirror 119 based on the exposure from a light-emitting part 118. Here, the light-emitting part 118 and 1st light sensing portion 120 grade which constitute the foreign matter detection system 100 are prepared in locations other than a substrate holder or a washing station among on the substrate stage PST. And the light-receiving result of the 1st and 2nd light sensing portion 120 and 121 is outputted to the control unit CONT which constitutes a part of foreign matter detection system 100 as a photoelectrical signal. The control unit CONT is constituted so that the degree of contamination of optical element 2 front face may be measured based on a contrast result with the predetermined reflection factor beforehand remembered to be the real reflection factor which calculated the rate of a light reflex of optical element 2 front face as a real reflection factor, and calculated it based on the photoelectrical signal outputted from the 1st and 2nd light sensing portion 120 and 121. That is, if the foreign matter has adhered to the optical element 2, it will originate in this foreign matter, the scattered light will arise, a reflection factor will change, and the light income received by the 1st light sensing portion 120 will change. The rate of a light reflex of optical element 2 front face measured at the time of this equipment completion assumed that the control unit CONT is not polluted, so that optical element 2 front face affects an optical property is beforehand memorized as a predetermined reflection factor.

[0088]

As explained with reference to drawing 13 or drawing 14 , after ending washing processing of the optical element 2 at the tip of projection optics PL, a control device CONT moves on the substrate stage PST, and arranges the foreign matter detection system 100 under projection optics PL. And if a predetermined exposure light is irradiated from a light-emitting part 118, after the exposure light which penetrated the branching mirror 119 among that exposure light irradiates optical element 2 front face, it will be reflected on this front face, and that reflected light will be received by the 1st light sensing portion 120. On the other hand, the exposure light (branching light) which branched by the branching mirror 119 is received by the 2nd light sensing portion 121, without reaching optical element 2 front face. And the photoelectrical signal photo electric conversion was carried out [the signal] by both the light sensing portions 120 and 121 is outputted to a control unit CONT, respectively. A control unit CONT calculates the reflection factor of optical element 2 front face based on the photoelectrical signal from the 1st light sensing portion 120, and the photoelectrical signal from the 2nd light sensing portion 121. That is, generally, when light carries out incidence by a certain incident angle to the interface of two media, the reflection factor R sets the strength of the energy of incoming beams to I0, and it is Ir about the strength of the energy of a reflected light bundle. It is expressed with R=Ir / I0 when it carries out. Therefore, with a control unit CONT, it is Ir about the strength of energy based on the photoelectrical signal from the 1st light sensing portion 120. It is the real reflection factor Rr of optical element 2 front face, carrying out and using the strength of energy based on the photoelectrical signal from the 2nd light sensing portion 121 as I0. It asks. Next, a control unit CONT is read-out, this predetermined reflection factor R0, and said real reflection factor Rr about the predetermined reflection factor R0 memorized beforehand. Difference deltaR (=R0-Rr) is calculated. And both called-for reflection factors R0 and Rr The status signal based on difference deltaR is outputted to a display 126. Then, a display 126 carries out the digital readout of the degree of contamination of optical element 2 front face based on this status signal. When the degree of contamination is over the predetermined allowed value, a control unit CONT judges that a foreign matter exists in optical element 2 front face more than an allowed value, and controls a washing station to perform washing processing again.
[0089]
In addition, it is detectable whether the foreign matter has adhered by irradiating exposure light at an optical element 2, and measuring an illuminance by each of a focal plane and a defocusing side here using the illuminance sensor formed on the substrate stage PST, since illuminance unevenness or a TERESEN gap is observed at the image surface side of projection optics PL when the foreign matter has adhered to the optical element 2 although it is the configuration of detecting the scattered light in optical element 2 front face.
[0090]
In addition, although he is trying to detect the liquid and foreign matter (impurity) which adhered to optical element 2 front face by irradiating light at an optical element 2 and receiving the scattered light, the detection approach is not restricted to this, for example, you may make it detect it in the operation gestalt of drawing 15 using the above-mentioned mask alignment system 6.
[0091]
Moreover, it checks whether the foreign matter has adhered to the optical element 2 at the tip of projection optics PL to the predetermined timing whose substrates P are not only after washing of optical element 2 front face but under exchange etc. by the foreign matter detection system, and when a foreign matter is detected, it may be made to perform washing actuation.
[0092]
Moreover, although the foreign matter detection system 100 is performing foreign matter detection of the optical element 2 at the tip of projection optics PL, you may make it detect the foreign matter of other bill-of-materials sides which contact a liquid by the image surface side of projection optics PL.
[0093]
<Another operation gestalt of the aligner using the 1st liquid stripper>
Drawing 16 is drawing showing another operation gestalt of the aligner which used the 1st liquid stripper. In this operation gestalt, plate member (superior lamella) 138A which constitutes some illuminance nonuniformity sensors (measurement system) 138 which receive the light irradiated by Z stage 52 through projection optics PL at the image surface side (Substrate P side) is prepared, and the liquid absorption member 142 which collects the liquids further removed from plate member 138A in the near is added. The liquid absorption member 142 is arranged in the slot 144 formed in Z stage 52. Moreover, patterning of the plate member 138A is carried out with the thin film which contains protection-from-light nature ingredients, such as chromium, on the surface of a glass plate, and it prepares pinhole 138P in the center section. Moreover, the top face of plate member 138A has liquid repellance. In this operation gestalt, coating of the ingredient which has the liquid repellance of a fluorine system compound etc. is carried out to the front face of plate member 138A.
[0094]
Drawing 17 is drawing showing signs that the liquid adhering to plate member 138A which is prepared in the substrate stage PST and constitutes some illuminance nonuniformity sensors 138 is removed. In this operation gestalt, the illuminance nonuniformity sensor 138 measures the illuminance (reinforcement) of the exposure light irradiated through projection optics PL at an image surface side in two or more locations, and measures the illuminance nonuniformity (illumination distribution) of the exposure light irradiated at the image surface side of projection optics PL as indicated by JP,57-117238,A. The illuminance nonuniformity sensor 138 is formed in the substrate stage PST (Z stage 52), carries out patterning of the light-shielding film on the surface of a glass plate, is laid under plate member 138A by which pinhole 138P were formed in the center section, and Z stage 52, and has optical-system 138C by which the light which passed pinhole 138P is irradiated, and photo detector (light-receiving system) 138B which receives the light which passed optical-system 138C. In addition, relay optical system can be established, for example between optical-system 138C and photo detector 138B, and photo detector 138B can also be arranged on the outside of Z stage 52.
[0095]
When measuring illumination distribution by the illuminance nonuniformity sensor 138, in the condition of having made projection optics PL and plate member 138A of the illuminance nonuniformity sensor 138 countering While filling between the projection optics PL and plate member 138A with a liquid, as pinhole 138P are moved one by one and mentioned above in two or more locations in the exposure field where exposure light is irradiated, the illuminance of the exposure light in each location is measured, and illumination distribution (illuminance nonuniformity) is searched for (it measures).

After illuminance distribution measurement termination, a control device CONT moves on the substrate stage PST, and arranges plate member 138A of the illuminance nonuniformity sensor 138 under the nozzle section 43 of the 1st liquid stripper 40.
[0096]
As mentioned above, the liquid absorption member 142 which collects the liquids removed from plate member 138A by the 1st liquid stripper 40 is formed in the location which adjoins on Z stage 52 at plate member 138A. Like the above-mentioned liquid absorption member 42, the liquid absorption member 142 is constituted by foam, such as porous ceramics and sponge, and specified quantity maintenance of a liquid is possible for it.
[0097]
A control unit CONT blows away and removes the liquid adhering to plate member 138A by spraying a gas from the nozzle section 43 of the 1st liquid stripper 40 to plate member 138A. The blown-away liquid is held at the liquid absorption member 142 arranged in diffuser 43A of the nozzle section 43 of the 1st liquid stripper 40, and the location which counters (recovery). In addition, since liquid-repellency treatment is performed to the front face of plate member 138A, it not only can prevent permeation of the liquid inside pinhole 138P, but a liquid is removable from plate member 138A by spraying a gas good.
[0098]
The passage 145 which follows a slot 144 is formed in the Z stage 52 interior, and the pars basilaris ossis occipitalis of the liquid absorption member 142 arranged in the slot 144 is connected to passage 145. Passage 145 is connected to the end section of the duct 146 established in the Z stage 52 exterior. On the other hand, the other end of a duct 146 is connected to the pump 149 through the duct 148 which has the tank 147 and bulb 148A which are prepared in the Z stage 52 exterior. Outflow way 147A is prepared in the tank 147, and a liquid 1 is discharged from outflow way 147A at the time of specified quantity ********. And a control unit CONT drives a pump 149, and as it absorbs the liquid collected by the liquid absorption member 142 on a tank 147, it brings it together in it, while it drives gas feed zone 41A of the 1st liquid stripper 40.
[0099]
In addition, as the liquid removal approach of plate member 138A by the 1st liquid stripper 40, suction of a liquid which was explained with the previous operation gestalt, blasting of a dried air, etc. may be used, and you may use it, combining them suitably. Moreover, the front face of plate member 138A does not have to make the whole surface liquid repellance, and only a part may make only the perimeter of pinhole 138P liquid repellance. Moreover, not only the top face of plate member 138A of the illuminance nonuniformity sensor 138 but the front face of other components on the substrate stage PST may be made into liquid repellance. However, by the 1st liquid stripper 40, when removal capacity is sufficiently high, it is not necessary to necessarily make it liquid repellance.
[0100]
Moreover, on the substrate stage PST, sensors which receive the exposure light which passed projection optics PL and a liquid through the light transmission section, such as a space image measurement sensor for measuring an exposure monitor which is indicated by not only an illuminance nonuniformity sensor but JP,11-16816,A, the image formation property currently indicated by JP,2002-14005,A, are arranged elsewhere. Since a liquid may remain and adhere on the front face of a flat part in which the light transmission section is formed, these sensors may also apply removal of the liquid using the 1st liquid stripper 40 to those sensors. Moreover, when a reflective member which is indicated by JP,62-183522,A on the substrate stage PST is arranged, the 1st liquid removal device 40 is used and you may make it remove the liquid which remained and adhered on the front face.
[0101]
Moreover, after using the 1st liquid stripper 40 and removing a liquid, you may make it remove, in case a removable sensor is removed from the substrate stage PST to the substrate stage PST which is indicated by JP,11-238680,A and JP,2000-97616,A.
[0102]
<The operation gestalt of the aligner using the 3rd liquid stripper>.
Drawing 18 is the mimetic diagram showing another operation gestalt of the aligner which used the 3rd liquid stripper. The focal detection system 4 is equipped with light-emitting part 4a and light sensing portion 4b in drawing 18 . In this operation gestalt, the 1st optical member 151 which can penetrate the detection light injected from light-emitting part 4a of the focal detection system 4 near the point of projection optics PL, and the 2nd optical member 152 which can penetrate the detection light reflected on Substrate P are formed. The 1st optical member 151 and the 2nd optical member 152 are supported in the condition of having dissociated in the optical element 2 at the tip of projection optics PL, the 1st optical member 151 is arranged at the -X side of an optical element 2, and the 2nd optical member 152 is arranged at the +X side of an optical element 2. The 1st and 2nd optical members 151 and 152 are formed in the location which can contact the liquid 1 of the immersion field AR 2 in the location which does not bar the optical path of the exposure light EL, and migration of Substrate P.
[0103]
And supply and recovery of a liquid 1 are performed by the liquid feeder style 10 and the liquid recovery device 30 as shown in drawing 18 , for example, so that all the optical paths of the exposure light EL which passed projection optics PL during exposure processing of Substrate P, i.e., the optical path of the exposure light EL between an optical element 2 and Substrate P (the projection field AR 1 on Substrate P), may be filled with a liquid 1. Moreover, all the optical paths of the exposure light EL between an optical element 2 and Substrate P are filled with a liquid 1, and when it is formed in a request condition so that the immersion field AR 2 may cover all the projection fields AR 1 on Substrate P, the liquid 1 which forms the immersion field AR 2 is stuck to each of the end face of the 1st optical member 151 and the 2nd optical member 152 (contact). In the condition that the immersion field AR 2 was formed on Substrate P, and the liquid 1 has stuck to each of the end face of the 1st optical member 151 and the 2nd optical member 152 All the optical paths between the 1st optical member 151 and the 2nd optical member 152 are filled with a liquid 1 among the optical paths of the detection light injected from light-emitting part 4a of the focal detection system 4, and the reflected light on the substrate P. Moreover, in the condition that all the optical paths of detection light were filled with the liquid 1, the detection light injected from light-emitting part 4a of the focal detection system 4 is set up so that the projection field

AR 1 of the projection optics PL on Substrate P may irradiate.
[0104]
Moreover, the liquid contact surface which is an end face of the above-mentioned 1st and 2nd optical members 151 and 152 is lyophilic--ization-processed, for example, and serves as lyophilic. Since it becomes easy to stick the liquid 1 of the immersion field AR 2 to the liquid contact surface of the 1st and 2nd optical members 151 and 152 by carrying out like this, it becomes easy to maintain the configuration of the immersion field AR 2.
[0105]
In addition, in drawing 18 , the liquid feeder style 10 and the liquid recovery device 30 are simplified and illustrated. The liquid feeder style 10 shown in drawing 18 is equipped with the supply pipe 172 which connects the liquid feed zone 171 which can send out a liquid 1, and the supply nozzle 173 and the liquid feed zone 171. After the liquid 1 sent out from the liquid feed zone 171 passes a supply pipe 172, it is supplied on Substrate P from the liquid feed hopper 174 of the supply nozzle 173. Moreover, the liquid recovery device 30 shown in drawing 18 is equipped with the recovery tubing 176 which connects the liquid stripping section 175 which can collect liquids 1, and the recovery nozzle 177 and the liquid stripping section 175. After the liquids 1 on Substrate P are collected from the recovery opening 178 of the recovery nozzle 177, they are collected by the liquid stripping section 175 through the recovery tubing 176.
[0106]
In addition, although it explained that the 1st optical member 151 and the 2nd optical member 152 were members which carried out mutually-independent here For example, an annular optical member is arranged so that the optical element 2 of the point of projection optics PL may be surrounded, detection light is irradiated at a part of the annular optical member, and you may make it receive the detection light which passed through the immersion field AR 2 and the substrate P front face through an annular optical member. The configuration of the immersion field AR 2 is maintainable good by preparing an optical member annularly and sticking the liquid 1 of the immersion field AR 2 to the medial surface of an annular optical member. Moreover, in this operation gestalt, the 1st optical member 151 and the 2nd optical member 152 may be formed by the optical element 2 of projection optics PL, and one, although it has dissociated to projection optics PL.
[0107]
After performing immersion exposure processing in the condition which showed in drawing 18 , a control unit CONT For example, as explained with reference to drawing 13 , a washing plate (or dummy substrate) is arranged under projection optics PL. The immersion field AR 2 is formed on a washing plate using the liquid feeder style 10 and the liquid recovery device 30. The liquid 1 of this immersion field AR 2 washes about 174 feed hopper of the optical element 2 and the 1st and 2nd optical members 151 and 152 of the point of projection optics PL, or the supply nozzle 173, and about 178 recovery opening of the recovery nozzle 177. After this washing is completed, a control unit CONT collects the liquids 1 of the immersion field AR 2 using the liquid recovery device 30 etc.
[0108]
After collecting the liquids 1 of the immersion field AR 2, a control unit CONT arranges a gas under projection optics PL with the driving gear whose gas nozzle 160 (the 3rd liquid stripper) blowing off is not illustrated, as shown in drawing 19 . At this time, the substrate stage PST is moved to the load unload location (refer to drawing 9), in order to carry out the unload of the substrate P, and the gas nozzle 160 is arranged under projection optics PL by the non-illustrated driving gear. Moreover, under projection optics PL, the liquid receptacle member 280 which receives the liquid 1 which fell from the optical element 2 grade is arranged. In addition, the gas nozzle 160 may be formed in locations other than the substrate holder which holds Substrate P among on the substrate stage PST.
[0109]
A control unit CONT blows off a gas from the outlet 161 of the gas nozzle 160, and moves the location of the liquid 1 adhering to an optical element 2, the 1st and 2nd optical members 151 and 152 or the supply nozzle 173, and the recovery nozzle 177 using the emitted gas. For example, first, as shown in drawing 19 , a control unit CONT blows off a gas from an outlet 161, after moving at a substrate side and parallel to the location which countered the field to which the exposure light EL of inferior-surface-of-tongue 2a of an optical element 2 passes the outlet 161 of the gas nozzle 160 (in the direction of X). Where the condition of having blown off the gas is maintained, it moves toward the outside of the field where the exposure light EL passes the gas nozzle 160. The liquid (drop) 1 which has adhered to the field through which the exposure light EL passes in inferior-surface-of-tongue 2a of an optical element 2, i.e., the field corresponding to the projection field AR 1 of inferior-surface-of-tongue 2a of an optical element 2, by this is movable to the outside of the field. In this operation gestalt, since the field through which the exposure light EL passes is the abbreviation center section of inferior-surface-of-tongue 2a of an optical element 2, the gas 1 which had adhered to the center section of inferior-surface-of-tongue 2a by the above-mentioned approach (residual) is movable toward the edge of inferior-surface-of-tongue 2a (refer to sign 1of drawing 19 '). If it puts in another way, he is trying for a control unit CONT to remove the liquid adhering to the field through which the exposure light EL passes by removing to the outside of the field, without drying the liquid 1 adhering to the field through which the exposure light EL passes using the emitted gas. It can prevent un-arranging [for which a watermark is formed in the field through which the exposure light EL passes at least among inferior-surface-of-tongue 2a of an optical element 2 by this]. In this operation gestalt, the gas nozzle 160 and its attachment function as the 3rd liquid stripper.
[0110]
in addition, in this operation gestalt, a liquid is removed from the field through which the exposure light EL passes (it removes) -- what is necessary is just to remove a liquid from a desired field not only it but if needed, although it is made like
[0111]
Drawing 20 (a) is drawing showing an example of an outlet 161. As shown in drawing 20 (a), in this operation gestalt, the outlet 161 is formed in the shape of [which makes Y shaft orientations a longitudinal direction] a slit. Drawing 20 (b) is drawing showing inferior-surface-of-tongue 2a of an optical element 2. The projection field AR 1 has the shape of a slit which makes Y shaft orientations a longitudinal direction (the shape of a rectangle). Moreover, the magnitude of an outlet 161 is formed smaller than inferior-surface-of-tongue 2a of an optical element 2. And in case the liquid 1 adhering to the center section of inferior-surface-of-tongue 2a of an optical element 2 is removed, a control unit CONT blows off a gas

first in the outlet 161 of the gas nozzle 160, and the condition of inferior-surface-of-tongue 2a of an optical element 2 of having countered the center section mostly, is in the condition which maintained the blowdown of the gas, and moves the gas nozzle 160 to the +X side (or the -X side). That is, a control unit CONT moves the gas nozzle 160 in accordance with X shaft orientations. By carrying out like this, a control unit CONT can move a liquid 1 to the outside of the field corresponding to the projection field AR 1 of inferior-surface-of-tongue 2a of an optical element 2 smoothly (it removes). In order to take out to the outside of the field corresponding to the projection field AR 1, when it is going to move the liquid 1 adhering to the center section (center section of the field corresponding to the projection field AR 1) of inferior-surface-of-tongue 2a of an optical element 2 in accordance with Y shaft orientations, since the projection field AR 1 makes Y shaft orientations the longitudinal direction, the migration length becomes long. In this case, it may become difficult to move a liquid 1 to the outside of said field smoothly. Therefore, the liquid 1 can be smoothly moved to the outside of said field by moving in accordance with X shaft orientations, in order to take out the liquid 1 adhering to the center section (center section of the field corresponding to the projection field AR 1) of inferior-surface-of-tongue 2a of an optical element 2 to the outside of the field corresponding to the projection field AR 1.
[0112]
In this operation gestalt, the gas which blows off from the outlet 161 of the gas nozzle 160 blows off as a clean gas through the filter equipment (un-illustrating) containing a chemical filter or a particle removal filter. Therefore, contamination of optical element 2 grade is prevented. Moreover, it is desirable to use the gas almost same as a gas as the environment where Aligner EX is set, and the almost same gas as the gas inside the chamber, in which Aligner EX was specifically held. Air (dried air) is used in this operation gestalt. In addition, nitrogen gas (dry nitrogen) may be used as a gas blowing off. Although it may carry out changing the optical path of the measuring beam of an interferometer which performs for example, stage location measurement etc. and may cause un-arranging, such as a measurement error, by the refractive-index difference of a mutually different gas when a different gas from the environment where Aligner EX is set is used, it can prevent above-mentioned un-arranging by making the gas which blows off from an outlet 161 into the almost same gas as the environment where Aligner EX is set.
[0113]
The liquid (it turned down) 1 which moved to the outside of the field through which the exposure light EL passes is evaporated and (desiccation) removed by the gas and the predetermined dryer which blew off from the gas nozzle 160.
[0114]
In addition, since washing of components (inferior-surface-of-tongue 2a of an optical element 2) is performed before blowing off a gas from the gas nozzle 160 even if the liquid moved to the outside of the field through which the exposure light EL passes gets dry, it can control that an impurity etc. adheres at the place where the liquid of the outside of the field through which the exposure light EL passes got dry.
[0115]
Moreover, it may be made to attract the liquid moved to the outside of the field through which the exposure light EL passes (recovery).
[0116]
Similarly, a control unit CONT moves the liquid (drop) adhering to the field through which the detection light of the focal detection system 4 passes at least among the end faces of the 1st and 2nd optical members 151 and 152 using the gas which blew off from the gas nozzle 160 (it removes). By carrying out like this, it can prevent un-arranging [for which a watermark is formed in the field through which detection light passes at least among the end faces of the 1st and 2nd optical members 151 and 152 (an impurity adheres)].
[0117]
Similarly, a control unit CONT removes the liquid 1 adhering to the supply nozzle 173 or the recovery nozzle 177 (residual) with the gas which blew off from the gas nozzle 160. By carrying out like this, it can prevent un-arranging [for which a watermark is formed in the supply nozzle 173 or the recovery nozzle 177]. When the watermark was formed in the supply nozzle 173 (feed hopper 174) or the recovery nozzle 177 (recovery opening 178) since it became a foreign matter (impurity) for example, and the immersion field AR 2 is formed, the foreign matter (impurity) by the watermark may mix a watermark in the immersion field AR 2. In that case, degradation of exposure precision or measurement precision is caused. Moreover, if it is possible that the recovery capacity of the liquid recovery device 30 changes, a watermark is formed in the recovery nozzle 177 of the contact angle (compatibility) over the liquid 1 of the recovery nozzle 177 (recovery opening 178) and a contact angle with a liquid 1 changes with them, the recovery capacity of the liquid recovery device 30 may deteriorate. However, it can prevent above-mentioned un-arranging by removing the liquid 1 which adhered to nozzles 173 and 177 like this operation gestalt.
[0118]
As explained above, the liquid adhering to the predetermined field (field where exposure light and detection light are irradiated) of an optical element 2 or the 1st and 2nd optical members 151 and 152 By what (it removes) is moved to the outside of a predetermined field by spraying a gas, moving the gas nozzle 160 (outlet 161) relatively to the predetermined field, it can prevent un-arranging [by which a watermark is formed in the predetermined field].
[0119]
In addition, although it is the configuration which moves the gas nozzle 160 almost linearly toward the edge of inferior-surface-of-tongue 2a where blasting of the gas is maintained after spraying a gas on the center section of inferior-surface-of-tongue 2a first when removing the liquid 1 adhering to inferior-surface-of-tongue 2a of an optical element 2 at the edge in this operation gestalt You may make it move the gas nozzle 160 so that an outlet 161 may draw a spiral locus to inferior-surface-of-tongue 2a. Moreover, the configuration of an outlet 161 may not be restricted in the shape of a slit, for example, may be configurations of arbitration, such as a circle configuration. Moreover, a porous body may be arranged to an outlet 161.
[0120]
Moreover, although the number of the gas nozzles 160 (outlet 161) is one in this operation gestalt, two or more natural gas nozzles 160 (outlet 161) may be formed, and they may be used together. Moreover, the liquid 1 which adhered to the optical element 2 using the gas which blew off from the 1st gas nozzle 160 among two or more gas nozzles 160 is removed, the liquid 1 which adhered to the 1st optical member 151 or the 2nd optical member 152 using the gas which

blew off from the 2nd gas nozzle 160 is removed, and it may be made to perform those removal actuation in parallel. Thus, a liquid removal activity can be efficiently done by performing liquid removal actuation to each of two or more predetermined fields in parallel using two or more gas nozzles 160.
[0121]
Moreover, the gas which blew off from diffuser 64A of the 2nd liquid stripper 60 explained with reference to drawing 8 etc. in order to move the liquid 1 adhering to the end face of an optical element 2 or the 1st and 2nd optical members 151 and 152 (it removes) may be used.
[0122]
Although it is the configuration of spraying a gas from a lower part to an optical element 2 or the 1st and 2nd optical members 151 and 152, you may make it spray from the upper part in the operation gestalt mentioned above. For example, as shown in drawing 21 , the liquid 1 which formed the outlet 161 of the gas nozzle 160 so that the bottom might be turned to, and adhered to the end face of the 2nd optical member 152 is removed, and it is good even if like (it removes). Of course, the liquid 1 which adhered to the end face of the 1st optical member 151 using this gas nozzle 160 is also removable. Or it is also possible to spray the gas which formed the gas nozzle 164 linked to the passage 163 in the end face of the 1st optical member 151 while forming passage 163 in a part of 1st optical member 151 (or the 2nd optical member 152), and minded passage 163 and the gas nozzle 164 from the upper part on the end face of the 1st optical member 151. In addition, passage 163 is formed in the location which does not bar the optical path of the detection light of the focal detection system 4.
[0123]
In addition, in the operation gestalt mentioned above, although the gas nozzle 160 was used and the liquid is removed after washing about 174 feed hopper of the optical element 2 and the 1st and 2nd optical members 151 and 152 of the point of projection optics PL, or the supply nozzle 173, and about 178 recovery opening of the recovery nozzle 177, a washing process may be skipped.
[0124]
Moreover, you may make it move the gas nozzle 160 by forming the gas nozzle 160 in the substrate stage PST like the above-mentioned 2nd operation gestalt, and moving the substrate stage PST.
[0125]
Moreover, the movable stage is further carried for the image surface side of projection optics PL, and you may make it arrange the gas nozzle 160 independently on the stage with the substrate stage PST as indicated by JP,11-135400,A.
[0126]
In the operation gestalt mentioned above, it is also possible to blow off a gas from an outlet 161, and to move the liquid 1 which remains on the substrate stage PST by spraying a gas (adhesion), although the liquid 1 adhering to an optical element 2, the 1st and 2nd optical members 151 and 152, or nozzles 173 and 177 is moved (for it to remove and turn down). For example, an outlet 161 is arranged so that it may counter with the top face of the substrate stage PST, a gas is sprayed to the criteria member 7 explained with reference to drawing 3 etc., and what (it removes) the liquid 1 which has adhered on the criteria member 7 is moved for to the outside (or inside on the criteria member 7 outside of a detection object domain) of the criteria member 7, without drying is made. The liquid 1 which similarly adhered on superior lamella 138A of the illuminance nonuniformity sensor 138 explained with reference to drawing 16 etc., an exposure monitor which is indicated by JP,11-16816,A, and the liquid 1 which adhered on the superior lamella of a space image measurement sensor which is indicated by JP,2002-14005,A can be moved, without spraying and drying a gas (it removes).
[0127]
<The operation gestalt of the aligner using the 4th liquid stripper>
Drawing 22 is drawing showing the operation gestalt of an aligner equipped with the 4th liquid stripper. In drawing 22 , the end section of the gas supply pipe 181 is connected in the middle of the supply pipe 172 through the passage transfer devices 182, such as the Mikata bulb. On the other hand, the other end of the gas supply pipe 181 is connected to the gas feed zone 180. The passage transfer device 182 closes the passage which connects the gas feed zone 180 and a feed hopper 174, when having opened the passage which connects the liquid feed zone 171 and a feed hopper 174. On the other hand, the passage transfer device 182 opens the passage which connects the gas feed zone 180 and a feed hopper 174, when having closed the passage which connects the liquid feed zone 171 and a feed hopper 174. Similarly, the end section of the gas supply pipe 184 is connected in the middle of the recovery tubing 176 through the passage transfer device 185, and the other end is connected to the gas feed zone 183. The passage transfer device 185 closes the passage which connects the gas feed zone 183 and the recovery opening 178, when having opened the passage which connects the liquid stripping section 175 and the recovery opening 178. On the other hand, the passage transfer device 185 opens the passage which connects the gas feed zone 183 and the recovery opening 178, when having closed the passage which connects the liquid stripping section 175 and the recovery opening 178.
[0128]
With this operation gestalt, the passage transfer device 182 etc. operates as the 4th liquid stripper (liquid device device) which removes a residual liquid object in the gas feed zones 180 and 183, a feed hopper 174 and the recovery opening 178, and a list.
[0129]
For example, when forming the immersion field AR 2 on Substrate P, a control unit CONT drives the passage transfer devices 182 and 185, and it opens the passage which connects the liquid stripping section 175 and the recovery opening 178 while it opens the passage which connects the liquid feed zone 171 and a feed hopper 174. At this time, the passage which connects the gas feed zone 180 and a feed hopper 174, and the passage which connects the gas feed zone 183 and the recovery opening 178 are closed.
[0130]
After immersion exposure of Substrate P is completed, only the predetermined period after a halt of the liquid supply actuation continues the liquid recovery actuation by the liquid recovery device 30, and a control unit CONT collects the liquids 1 in which the immersion field AR 2 was formed while suspending the liquid supply actuation by the liquid feeder style 10. When suspending the liquid supply actuation by the liquid feeder style 10, a control unit CONT drives the

passage transfer device 182, and it opens the passage which connects the gas feed zone 180 and a feed hopper 174 while it closes the passage which connects the liquid feed zone 171 and a feed hopper 174. And after the liquid 1 of the immersion field AR 2 is lost mostly, a control unit CONT drives the gas feed zone 180, and starts gaseous supply. The gas supplied from the gas feed zone 180 blows off from the feed hopper 174 of the supply nozzle 173 through the gas supply pipe 181 and the passage transfer device 182. Thereby, the liquid 1 which remains to the passage between the passage transfer device 182 and a feed hopper 174 can be blown off and removed outside through a feed hopper 174. In addition, it is supplied from the gas feed zone 180, and the liquid 1 adhering to the end face of the 1st and 2nd optical members 151 and 152 and the liquid 1 which has adhered on the substrate stage PST (a measurement member etc. is included) can also be removed, using the gas which blew off from the feed hopper 174.

[0131]

Similarly, after recovery actuation of the liquid 1 of the immersion field AR 2 by the liquid recovery device 30 is completed, a control unit CONT drives the passage transfer device 185, and it opens the passage which connects the gas feed zone 183 and the recovery opening 178 while it closes the passage which connects the liquid stripping section 175 and the recovery opening 178. And a control unit CONT blows off and removes outside the liquid 1 which remains to the passage between the passage transfer device 185 and the recovery opening 178 through the recovery opening 178 using the gas supplied from the gas feed zone 183. In addition, it is also possible to remove the liquid 1 adhering to the end face of the 1st and 2nd optical members 151 and 152 and the liquid 1 which has adhered on the substrate stage PST (a measurement member etc. is included) using the gas which blew off from the recovery opening 178.

[0132]

As explained above, when not performing supply or recovery of a liquid 1, it can prevent un-arranging [for which a watermark is formed in the internal passage of a supply pipe 172 and the supply nozzle 173, about 174 feed hopper, or the internal passage and about 178 recovery opening of the recovery tubing 176 or the recovery nozzle 177] by supplying a clean gas from the gas feed zones 180 and 183.

[0133]

<Another operation gestalt of the aligner using the 3rd liquid stripper>

Drawing 23 is drawing showing another operation gestalt of the aligner which used the 3rd liquid stripper. In drawing 23 , the gas nozzle 160 which has an outlet 161 is attached in the liquid receptacle member 190. The liquid receptacle member 190 is a dished member, is formed more greatly than the occupancy area of an optical element 2, nozzles 173 and 177, and the 1st and 2nd optical members 151 and 152, and can receive now the liquid 1 which dripped from these each part material. Moreover, the liquid absorption member 199 which consists of a porous body or a sponge-like member is formed in the pars basilaris ossis occipitalis of the liquid receptacle member 190 exchangeable. A liquid 1 can be made good a collection and maintenance by the liquid absorption member 199. Moreover, the liquid receptacle member 190 has the peripheral wall section 191, and the outflow of a liquid 1 by which the collection was carried out is prevented by the peripheral wall section 191.

[0134]

The liquid receptacle member 190 is formed movable by the drive 193. The drive 193 consists of the arm section 194, the actuator section 195, and a shank 196. One edge of the arm section 194 is connected to the side face of the liquid receptacle member 190, and the other-end section is connected to the actuator section 195. Moreover, the actuator section 195 is attached so that it may be hung by the predetermined supporters CL, such as a column which supports the body and projection optics PL of Aligner EX, through a shank 196. The liquid receptacle member 190 attached in the end section of the arm section 194 circles to theta Z direction by making a shank 196 into a center line of rotation because the actuator section 195 drives. A control device CONT can move the liquid receptacle member 190 to the lower part field of projection optics PL by driving the actuator section 195 of a drive 193 and circling in the liquid receptacle member 190. Moreover, through the arm section 194, the actuator section 195 can move the liquid receptacle member 190 also in the XY direction while it is movable to Z shaft orientations.

[0135]

Moreover, the image pick-up equipment 198 which consists of CCD etc. is formed in the liquid receptacle member 190. Image pick-up equipment 198 can output the surface information on an optical element 2 or the 1st and 2nd optical members 151 and 152 as an image.

[0136]

When moving the liquid 1 adhering to an optical element 2, the 1st and 2nd optical members 151 and 152, etc. (removal), while a control unit CONT drives the actuator section 195, counters an optical element 2 and the liquid receptacle member 190 and moves the gas nozzle 160 with the liquid receptacle member 190 to an optical element 2, a gas is sprayed to an optical element 2. The liquid 1 which has adhered to the field corresponding to the optical-path top of the exposure light EL among optical elements 2 moves with the sprayed liquid 1, and falls soon. The liquid 1 which fell from the optical element 2 is held at the liquid receptacle member 190. By carrying out like this, the liquid 1 removed from the optical element 2 etc. can prevent un-arranging adhering to the substrate stage PST by receiving a liquid 1 by the liquid receptacle member 190, when the substrate stage PST is arranged under projection optics PL and the liquid receptacle member 190.

[0137]

Moreover, a control unit CONT controls gas blasting actuation of the gas nozzle 160 based on the image pick-up result of image pick-up equipment 198. For example, it was able to be said that a control unit CONT asked for the location where the liquid 1 has adhered based on the image pick-up result of image pick-up equipment 198, carried out alignment of the location and the gas nozzle 160 to which the liquid 1 has adhered, and performed gaseous blasting. By carrying out like this, a liquid 1 can be removed more certainly. And when it judges that the liquid 1 was removed from the optical element 2, a control unit CONT ends the gas blasting actuation by the gas nozzle 160.

[0138]

In addition, the positioning device in which the liquid receptacle member 190 and the 1st and 2nd optical members 151 and 152 are positioned may be established. As a positioning device, the flat-spring member 192 shown with a broken line can be used for drawing 23 . In the example shown in drawing 23 , the flat-spring member 192 is formed in top-face 191A of the peripheral wall section 191 of the liquid receptacle member 190. If the liquid receptacle member 190 moves to + Z

direction and the 1st and 2nd optical members 151 and 152 are approached by the drive of the actuator section 195, the flat-spring member (positioning device) 192 will face across the outside of the 1st and 2nd optical members 151 and 152. Thereby, the 1st and 2nd optical members 151 and 152 and the liquid receptacle member 190 are positioned. In this case, although it is difficult to displace relatively the gas nozzle 160 attached in the liquid receptacle member 190 to the optical element 2 (the 1st and 2nd optical members 151 and 152), the liquid 1 which sprayed the gas which blew off from the gas nozzle 160 on the request field (field corresponding to the projection field AR 1 in this case) of an optical element 2, and adhered to that field can be removed good.

[0139]

<Still more nearly another operation gestalt of the aligner using the 3rd liquid stripper>

Drawing 24 is the side elevation showing another operation gestalt of the aligner which used the 3rd liquid stripper. In drawing 24 , the substrate stage PST was established in the plane view **** center section of the substrate stage PST, and equips Z shaft orientations with the movable pin center,large table 250. The pin center,large table 250 is formed by the non-illustrated drive it is movable to Z shaft orientations, and more possible [frequent appearance] than the top face of the substrate stage PST (Z stage 52). Moreover, the adsorption hole 251 is formed in top-face 250A of the pin center,large table 250. The adsorption hole 251 is connected to the end section of the passage 252 established in the interior of substrate stage PST. On the other hand, the other end of passage 252 is connectable with either the end section of the 1st passage 254, and the end section of the 2nd passage 255 through the passage transfer device 253. The other end of the 1st passage 254 is connected to the vacuum system 256, and the other end of the 2nd passage 255 is connected to the gas feed zone 257. The passage transfer device 253 closes the passage which connects the gas feed zone 257 and the adsorption hole 251, when having opened the passage which connects passage 252 and the 1st passage 254 and connects the vacuum system 256 and the adsorption hole 251. On the other hand, the passage transfer device 253 closes the passage which connects the vacuum system 256 and the adsorption hole 251, when having opened the passage which connects passage 252 and the 2nd passage 255 and connects the gas feed zone 257 and the adsorption hole 251.

[0140]

When Substrate P is loaded to the substrate stage PST, it goes up the pin center,large table 250, and a control device CONT lays Substrate P on the pin center,large table 250, drives the vacuum system 256, and carries out adsorption maintenance of the rear face of Substrate P through the adsorption hole 251. And a control device CONT descends the pin center,large table 250, where adsorption maintenance of the substrate P is carried out, and it makes Substrate P hold to the substrate holder on Z stage 52. For example, the pin chuck device is prepared in the substrate holder, and a substrate holder carries out adsorption maintenance of the substrate P according to a pin chuck device. On the other hand, when carrying out the unload of the substrate P from the substrate stage PST, on the pin center,large table 250, adsorption maintenance of the substrate P is carried out, and a control unit CONT goes up while canceling adsorption maintenance of the substrate P by the substrate holder. Where adsorption maintenance of the substrate P is carried out, when the pin center,large table 250 goes up, Substrate P separates from a Z stage and the unload of it becomes possible.

[0141]

In this operation gestalt, a gas is blown off from the adsorption hole 251 prepared in the pin center,large table 250, and the liquid 1 adhering to inferior-surface-of-tongue 2a of an optical element 2 or the 1st and 2nd optical members 151 and 152 is moved using the emitted gas (it removes). That is, when removing the liquid 1 adhering to an optical element 2 or the 1st and 2nd optical members 151 and 152, a control unit CONT drives the passage transfer device 253, and opens the passage which connects the gas feed zone 257 and the adsorption hole 251. And a control device CONT blows off a gas from the adsorption hole 251, moving along XY flat surface on the substrate stage PST. By the ability spraying a gas, it is moved and the liquid 1 which the optical element 2 inferior-surface-of-tongue 2a Struck, and had adhered to the field corresponding to the optical-path top of the exposure light EL falls soon.

[0142]

In this operation gestalt, the liquid receptacle member DP in which a collection is possible is held in the liquid 1 on Z stage 52 (substrate holder). The liquid receptacle member DP has magnitude almost equivalent to Substrate P, and can hold it to a substrate holder. The liquid 1 which fell from the optical element 2 is held at the liquid receptacle member DP held at the substrate holder. The liquid attachment component 261 is formed in the pars basilaris ossis occipitalis of the liquid receptacle member DP, and a liquid 1 is held by the liquid attachment component 261. Moreover, the liquid receptacle member DP has the peripheral wall section 262, and has prevented the outflow of the held liquid 1.

[0143]

Drawing 25 is drawing which looked at the liquid receptacle member DP currently held at the substrate holder from the upper part. In drawing 25 , two or more adsorption holes 251 are formed in top-face 250A of the pin center,large table 250, and are prepared three in this operation gestalt. Moreover, two or more (three) openings 264 corresponding to two or more adsorption holes 251 are formed in the liquid receptacle member DP. That is, the adsorption hole 251 is exposed to a substrate holder also in the condition that the liquid receptacle member DP was held. Therefore, the gas which blew off from the adsorption hole 251 can be sprayed on optical element 2 grade. Moreover, the slot 258 of plurality (three) which extends in the radiation direction is formed in top-face 250A of the pin center,large table 250 from the center section of top-face 250A, and the slot 258 of these plurality is continuing in the center section of top-face 250A. And the adsorption hole 251 is arranged inside the slot 258. When carrying out adsorption maintenance of the rear face of the substrate P which is an exposure processing object by top-face 250A of the pin center,large table 250, adsorption maintenance of the substrate P can be carried out on the pin center,large table 250 by making into negative pressure space which drives the vacuum system 256 in the condition of having contacted the rear face of Substrate P, and top-face 250A, and is formed in the rear face and slot 258 of Substrate P. On the other hand, also when holding the liquid receptacle member DP on the pin center,large table 250, the liquid receptacle member DP can be held on the pin center,large table 250 by setting up the configuration of opening 264 or a slot 258, magnitude or the magnitude of the adsorption hole 251, a location, etc. the optimal. Or the adsorption hole of the dedication for carrying out adsorption maintenance of liquid receptacle member DP with the another adsorption hole 251 and the slot corresponding to this are established in top-face 250A of the pin center,large table 250 (refer to [sign 251' of drawing 25 , and] 258'), and it may

be made to carry out adsorption maintenance of the liquid receptacle member DP to top-face 250A using this adsorption hole 251'. And the load unload of the liquid receptacle member DP can be carried out to the substrate stage PST like the substrate P which is an exposure processing object using this pin center,large table 250. And when doing the liquid removal activity of optical element 2 grade, the liquid receptacle member DP is loaded on the substrate stage PST, and when a liquid removal activity is completed, the unload of the liquid receptacle member DP on the substrate stage PST is carried out. Moreover, also when carrying out adsorption maintenance of the liquid receptacle member DP by the pin chuck device of a substrate holder, so that an abbreviation closed space can be formed among rear faces other than opening 264 among the liquid receptacle members DP For example, the field negative-pressure-ized in a pin chuck device is divided into plurality, and adsorption maintenance of the liquid receptacle member DP can be carried out at a substrate holder by performing negative pressure-ization alternatively in fields other than the field corresponding to said opening 264.

[0144]

In addition, since the liquid 1 held at the liquid receptacle member DP may permeate through opening 264 between the rear face of the liquid receptacle member DP, and top-face 250A (as a result, top face of a substrate holder) of the pin center,large table 250, it is desirable to prepare the seal member for preventing permeation of the liquid 1 in the rear face and about 264 opening of the liquid receptacle member DP.

[0145]

In addition, before spraying the gas which blew off from the adsorption hole 251 on optical element 2 grade, it is desirable to move the substrate stage PST to locations left with projection optics PL, such as the load unload location B (to refer to drawing 9), and to blow off a gas from the adsorption hole 251 in the location. Although the foreign matter (dust) may exist the interior and near the adsorption hole 251, projection optics PL is making it spray a gas on optical element 2 grade, after having performed gas blowdown actuation beforehand in the distant location and removing a foreign matter, and it can prevent un-arranging [which optical element 2 grade pollutes].

[0146]

Moreover, although the 1st - the 4th liquid stripper were explained, these strippers may be independently carried in Aligner EX, and you may make it carry them in Aligner EX in an above-mentioned operation gestalt, combining these strippers suitably.

[0147]

In addition, also in the operation gestalt shown in drawing 24 , diffuser 64A explained with reference to drawing 8 etc. can be prepared in locations other than the substrate holder which holds Substrate P among on the substrate stage PST, and the liquid 1 adhering to an optical element 2 etc. can be moved using the gas which blew off from the diffuser 64A.

[0148]

As mentioned above, the liquid 1 in this operation gestalt is constituted by pure water. Pure water has an advantage without the bad influence to a photoresist, an optical element (lens), etc. on Substrate P while being able to come to hand in large quantities easily by a semi-conductor plant etc. Moreover, since the content of an impurity is very low, pure water can also expect the operation which washes the front face of Substrate P, and the front face of an optical element established in the apical surface of projection optics PL, while not having a bad influence to an environment.

[0149]

And when the refractive index n of the pure water(water) to the exposure light EL whose wavelength is about 193nm is called about 1.44 and ArF excimer laser light (wavelength of 193nm) is used as the light source of the exposure light EL, on Substrate P, it is short-wavelength-ized by 1/n, i.e., about 134nm, and high resolution is obtained. Furthermore, when what is necessary is just to be able to secure the depth of focus comparable as the case where it is used in air since the depth of focus is expanded [be / it / under / air / comparing] to about n times, i.e., about 1.44 times, it can make the numerical aperture of projection optics PL increase more, and its resolution improves also at this point.

[0150]

With this operation gestalt, the optical element 2 is attached at the tip of projection optics PL, and this lens can perform the optical property of projection optics PL, for example, adjustment of aberration (spherical aberration, comatic aberration, etc.). In addition, as an optical element attached at the tip of projection optics PL, you may be the optical plate used for adjustment of the optical property of projection optics PL. Or you may be the plane-parallel plate which can penetrate the exposure light EL.

[0151]

In addition, when the pressure between the optical elements at the tip of projection optics PL and Substrates P which are produced by the flow of a liquid 1 is large, the optical element may not be made exchangeable, but you may fix strongly so that an optical element may not move with the pressure.

[0152]

In addition, with this operation gestalt, although it is the configuration currently filled with the liquid 1 between projection optics PL and a substrate P front face, it may be the configuration of filling a liquid 1 where the cover glass which consists of a plane-parallel plate is attached in the front face of Substrate P, for example.

[0153]

In addition, although the liquid 1 of this operation gestalt is water, since this F2 laser beam does not penetrate water when the light source of for example, the exposure light EL which may be liquids other than water is F2 laser, you may be fluorine system fluids which can penetrate F2 laser beam as a liquid 1, such as fault polyether [for example,] fluoride (PFPE) and fluorine system oil. In this case, into the part in contact with a liquid 1, it lyophilic--ization-processes by forming a thin film by the matter of the polar small molecular structure containing a fluorine. Moreover, if it considers as a liquid 1, there is permeability over the exposure light EL, a refractive index is high as much as possible, and it is also possible to use a stable thing (for example, cedar oil) to the photoresist applied to projection optics PL and a substrate P front face. Also in this case, surface treatment is performed according to the polarity of the liquid 1 to be used.

[0154]

In addition, as mentioned above, when an immersion method is used, the numerical aperture NA of projection optics may be set to 0.9-1.3. Thus, since the image formation engine performance may get worse according to the polarization effectiveness with the random polarization light used as an exposure light from the former when the numerical aperture

NA of projection optics becomes large, it is desirable to use polarization lighting. In that case, it is good to perform linearly polarized light lighting set by the longitudinal direction of Rhine [of a mask (reticle)] -, and the Rhine pattern of - tooth-space pattern, and for many diffracted lights of S polarization component (TE polarization component), i.e., the polarization direction component in alignment with the longitudinal direction of the Rhine pattern, to be made to be injected from the pattern of a mask (reticle). When between projection optics PL and the resists applied to the substrate P front face is filled with the liquid, Since the permeability on the front face of a resist of the diffracted light of S polarization component (TE polarization component) which contributes to improvement in contrast becomes high compared with the case where between projection optics PL and the resists applied to the substrate P front face is filled with air (gas), Even when the numerical aperture NA of projection optics exceeds 1.0, the high image formation engine performance can be obtained. Moreover, it is still more effective if the oblique incidence illumination (especially die ball illumination) doubled with the longitudinal direction of the Rhine pattern which is indicated by a phase shift mask and JP,6-188169,A is combined suitably. For example, the phase shift mask (about [half pitch 45nm] pattern) of the halftone mold of 6% of transmission When using together and illuminating linearly polarized light illumination and die ball illumination, the radius of each flux of light [in / for the lighting sigma specified by the circumscribed circle of the 2 flux of lights which form a die ball in the pupil surface of an illumination system / 0.95 and the pupil surface of those] 0.125sigma, If numerical aperture of projection optics PL is set to NA=1.2, the depth of focus (DOF) can be made to increase [rather than] by about 150nm using random polarization light.

[0155]

Moreover, make ArF excimer laser into exposure light, for example, and the projection optics PL of about 1/4 contraction scale factor is used. In the case so that detailed Rhine - and - tooth-space pattern (for example, about 25-50nm Rhine - and - tooth space) may be exposed on Substrate P Depending on the structure (for example, whenever [of a pattern / detailed], and thickness of chromium) of Mask M Mask M acts as a polarizing plate according to the Wave guide effectiveness, and many diffracted lights of S polarization component (TE polarization component) come to be injected from Mask M from the diffracted light of P polarization component (TM polarization component) to which contrast is reduced. In this case, although it is desirable to use above-mentioned linearly polarized light lighting, even if it illuminates Mask M with random polarization light, the numerical aperture NA of projection optics PL can obtain high definition ability like 0.9-1.3, even when large.

[0156]

moreover, the pole on Mask M, although P polarization component (TM polarization component) may become larger than S polarization component (TE polarization component) according to the Wire Grid effectiveness when exposing detailed Rhine - and - tooth-space pattern on Substrate P For example, make ArF excimer laser into exposure light, and the projection optics PL of about 1/4 contraction scale factor is used. In exposing larger Rhine - than 25nm and - tooth-space pattern on Substrate P Since more diffracted lights of S polarization component (TE polarization component) than the diffracted light of P polarization component (TM polarization component) are injected from Mask M, the numerical aperture NA of projection optics PL can obtain high definition ability like 0.9-1.3, even when large.

[0157]

Furthermore, the combination of the polarization illumination and oblique incidence illumination which carry out the linearly polarized light is also effective for the direction of a tangent (periphery) of the circle centering on an optical axis as indicated by not only the linearly polarized light lighting (S polarization lighting) set by the longitudinal direction of the Rhine pattern of a mask (reticle) but JP,6-53120,A. When the Rhine pattern prolonged not only in the Rhine pattern with which the pattern of a mask (reticle) is especially prolonged in a predetermined one direction but in the direction in which plurality differs is intermingled, even when the numerical aperture NA of projection optics is large, the high image formation engine performance can be obtained by using together the polarization illumination and zona-orbicularis illumination which carry out the linearly polarized light to the tangential direction of the circle centering on an optical axis, as similarly indicated by JP,6-53120,A. For example, the phase shift mask (about [half pitch 63nm] pattern) of the halftone mold of 6% of transmission When using together and illuminating the polarization illumination and zona-orbicularis illumination (zona-orbicularis ratios 3/4) which carry out the linearly polarized light to the tangential direction of the circle centering on an optical axis, if lighting sigma is set to NA=1.00, the numerical aperture of 0.95 and projection optics PL The depth of focus (DOF) can be made to be able to increase [rather than] by about 250nm, and the depth of focus can be made to increase by about 100nm by numerical-aperture NA=1.2 of projection optics by the pattern which is about half pitch 55nm using random polarization light.

[0158]

In addition, as a substrate P of each above-mentioned operation gestalt, not only the semi-conductor wafer for semiconductor device manufacture but the glass substrate for display devices, the mask used with the ceramic wafer for the thin film magnetic heads or an aligner or the original edition (synthetic quartz, silicon wafer) of a reticle, etc. is applied.

[0159]

It is applicable also to the projection aligner (stepper) of the step-and-repeat method which one-shot exposure of the pattern of Mask M is carried out [method] in the condition of having stood still Mask M and Substrate P other than the scanning aligner (scanning stepper) of step - which carries out the synchronized drive of Mask M and the substrate P, and carries out scan exposure of the pattern of Mask M as an aligner EX, and - scanning method, and carries out step migration of the substrate P one by one. Moreover, this invention can apply at least two patterns also to the aligner of step - imprinted in piles partially and - SUTITCHI method on Substrate P.

[0160]

Moreover, this invention is applicable also to the aligner of the twin stage mold currently indicated by JP,10-163099,A, JP,10-214783,A, the ** table No. 505958 [2000 to] official report, etc.

[0161]

Moreover, in an above-mentioned operation gestalt, although the aligner which fills a liquid locally between projection optics PL and Substrate P is adopted, this invention is applicable also to the immersion aligner to which the stage holding the substrate for [which is indicated by JP,6-124873,A] exposure is moved in a cistern.

[0162]

As a class of aligner EX, it is not restricted to the aligner for semiconductor device manufacture which exposes a semiconductor device pattern to Substrate P, but can apply to the aligner for manufacturing an aligner, the thin film magnetic head, an image sensor (CCD), a reticle or a mask for the object for liquid crystal display component manufacture, or display manufacture, etc. widely.
[0163]
When using a linear motor (USP5,623,853 or USP5,528,118 reference) for the substrate stage PST and a mask stage MST, whichever of the magnetic levitation mold using the air surfacing mold and the Lorentz force, or the reactance force which air bearing was used may be used. Moreover, the type which moves along with a guide is sufficient as each stages PST and MST, and they may be guide loess types which do not prepare a guide.
[0164]
The flat-surface motor which the magnet unit which has arranged the magnet to two dimensions, and the armature unit which has arranged the coil to two dimensions are made to counter as a drive of each stages PST and MST, and drives each stages PST and MST according to electromagnetic force may be used. In this case, what is necessary is to connect either of a magnet unit and an armature unit to Stages PST and MST, and just to establish another side of a magnet unit and an armature unit in the migration side side of Stages PST and MST.
[0165]
The reaction force generated by migration of the substrate stage PST may be mechanically missed to the floor (earth) using a frame member as indicated by JP,8-166475,A (USP5,528,118), so that it may not get across to projection optics PL.
The reaction force generated by migration of a mask stage MST may be mechanically missed to the floor (earth) using a frame member as indicated by JP,8-330224,A (US S/N 08/416,558), so that it may not get across to projection optics PL.
[0166]
as mentioned above, the aligner EX of this application operation gestalt -- this application -- it is manufactured by assembling the various subsystems containing each component mentioned to the claim so that a predetermined mechanical precision, electric precision, and optical precision may be maintained. In order to secure these various precision, before and after this assembly, adjustment for attaining electric precision is performed about the adjustment for attaining mechanical precision about the adjustment for attaining optical precision about various optical system, and various mechanical systems, and various electric systems. Like the assembler from various subsystems to an aligner, the mechanical connections between [various] subsystems, wiring connection of an electrical circuit, piping connection of an atmospheric-pressure circuit, etc. are included. It cannot be overemphasized that it is in the front like the assembler from these various subsystems to an aligner like the assembler of each subsystem each. If it ends like the assembler to the aligner of various subsystems, comprehensive adjustment will be performed and the various precision as the whole aligner will be secured. In addition, as for manufacture of an aligner, it is desirable to carry out in the clean room where temperature, an air cleanliness class, etc. were managed.
[0167]
As micro devices, such as a semiconductor device, are shown in drawing 27 With the aligner EX of step 201 which performs the function and engine-performance design of a micro device, step 202 which manufactures the mask (reticle) based on this design step, step 203 which manufactures the substrate which is the base material of a device, and the operation gestalt mentioned above It is manufactured through the exposure processing step 204 which exposes the pattern of a mask to a substrate, the device assembly step (a dicing process, a bonding process, and a package process are included) 205, and inspection step 206 grade.
[Brief Description of the Drawings]
[0168]
[Drawing 1] It is the outline block diagram showing 1 operation gestalt of the aligner of this invention.
[Drawing 2] It is the outline block diagram showing the liquid feeder style and liquid recovery device for forming an immersion field.
[Drawing 3] It is the top view of a substrate stage.
[Drawing 4] It is drawing showing an example of the 2nd liquid recovery system.
[Drawing 5] It is the schematic diagram showing an example of the 1st liquid stripper which is a liquid removal device.
[Drawing 6] It is the schematic diagram showing an example of the 1st liquid stripper which is a liquid removal device.
[Drawing 7] It is the schematic diagram showing an example of the 1st liquid stripper which is a liquid removal device.
[Drawing 8] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 9] It is a mimetic diagram for explaining signs that a substrate stage moves.
[Drawing 10] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 11] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 12] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 13] It is the schematic diagram showing an example of a soaping-machine style.
[Drawing 14] It is the schematic diagram showing an example of a soaping-machine style.
[Drawing 15] It is the schematic diagram showing an example of a foreign matter detection system.
[Drawing 16] It is the top view showing another operation gestalt of a substrate stage.
[Drawing 17] It is the schematic diagram showing an example of the 1st liquid stripper.
[Drawing 18] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 19] It is the mimetic diagram showing another operation gestalt of the liquid removal actuation concerning this invention.
[Drawing 20] It is drawing showing the relation between a gas nozzle and an optical element.
[Drawing 21] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 22] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 23] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 24] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 25] It is the top view which looked at the important section of the substrate stage of drawing 24 from the upper

part.
[Drawing 26] It is the flow chart Fig. showing an example of the operations sequence of the aligner of this invention.
[Drawing 27] It is the flow chart Fig. showing an example of the production process of a semiconductor device.
[Description of Notations]
[0169]
1 [-- Liquid feeder style,] -- A liquid, 2 -- An optical element (components), 7 -- A criteria member, 10 13 14 -- A supply nozzle (components), 20 -- The 2nd liquid recovery system, 30 -- Liquid recovery device (the 1st liquid recovery system), 31 32 -- A recovery nozzle (components), 40 -- The 1st liquid stripper, 41 -- Blasting equipment, 60 [-- Recovery opening, 81 / -- An aspirator, AR1 / -- A projection field, AR2 / -- An immersion field, EX / -- An aligner, P / -- A substrate, PL / -- Projection optics, PST / -- Substrate stage] -- The 2nd liquid stripper, 61 -- Blasting equipment, 62 -- An aspirator, 65

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[0168]
[Drawing 1] It is the outline block diagram showing 1 operation gestalt of the aligner of this invention.
[Drawing 2] It is the outline block diagram showing the liquid feeder style and liquid recovery device for forming an immersion field.
[Drawing 3] It is the top view of a substrate stage.
[Drawing 4] It is drawing showing an example of the 2nd liquid recovery system.
[Drawing 5] It is the schematic diagram showing an example of the 1st liquid stripper which is a liquid removal device.
[Drawing 6] It is the schematic diagram showing an example of the 1st liquid stripper which is a liquid removal device.
[Drawing 7] It is the schematic diagram showing an example of the 1st liquid stripper which is a liquid removal device.
[Drawing 8] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 9] It is a mimetic diagram for explaining signs that a substrate stage moves.
[Drawing 10] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 11] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 12] It is the schematic diagram showing an example of the 2nd liquid stripper which is a liquid removal device.
[Drawing 13] It is the schematic diagram showing an example of a soaping-machine style.
[Drawing 14] It is the schematic diagram showing an example of a soaping-machine style.
[Drawing 15] It is the schematic diagram showing an example of a foreign matter detection system.
[Drawing 16] It is the top view showing another operation gestalt of a substrate stage.
[Drawing 17] It is the schematic diagram showing an example of the 1st liquid stripper.
[Drawing 18] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 19] It is the mimetic diagram showing another operation gestalt of the liquid removal actuation concerning this invention.
[Drawing 20] It is drawing showing the relation between a gas nozzle and an optical element.
[Drawing 21] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 22] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 23] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 24] It is the mimetic diagram showing another operation gestalt of the aligner of this invention.
[Drawing 25] It is the top view which looked at the important section of the substrate stage of drawing 24 from the upper part.
[Drawing 26] It is the flow chart Fig. showing an example of the operations sequence of the aligner of this invention.
[Drawing 27] It is the flow chart Fig. showing an example of the production process of a semiconductor device.

[Translation done.]

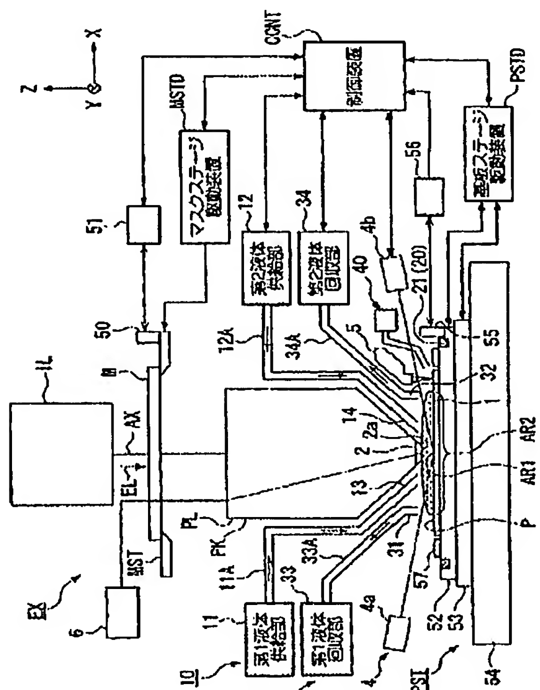
* NOTICES *

JPO and INPIT are not responsible for any
damages caused by the use of this translation.

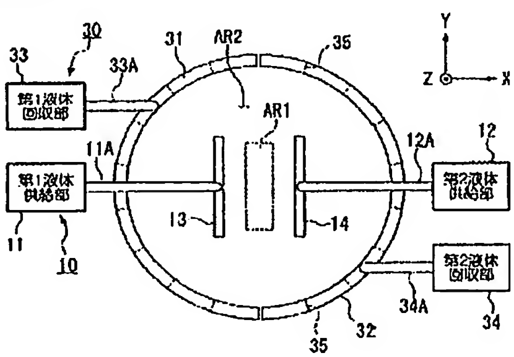
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

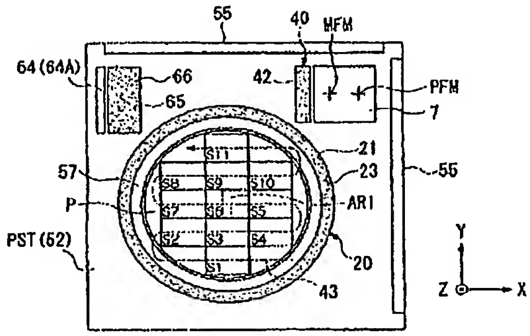
[Drawing 1]



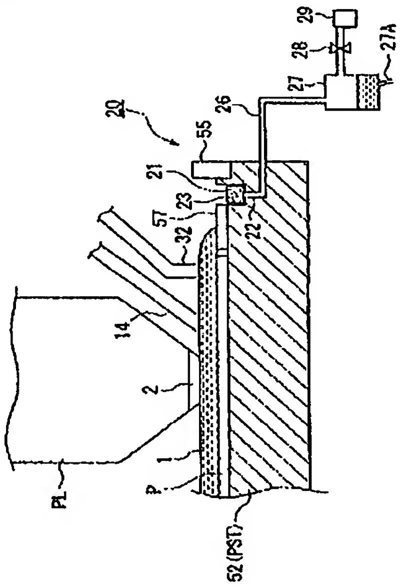
[Drawing 2]



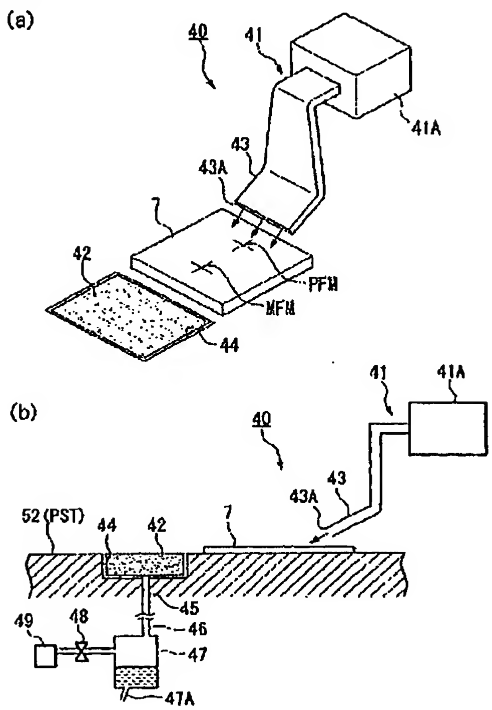
[Drawing 3]



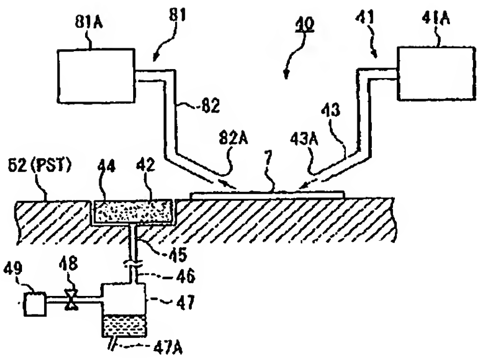
[Drawing 4]



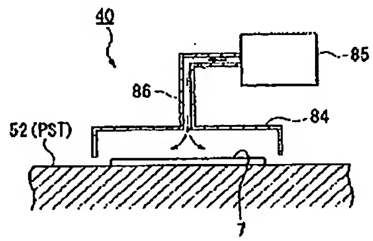
[Drawing 5]



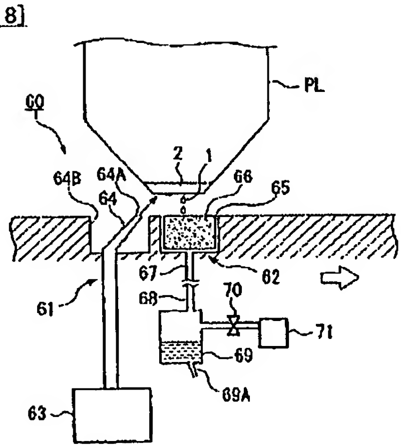
[Drawing 6]



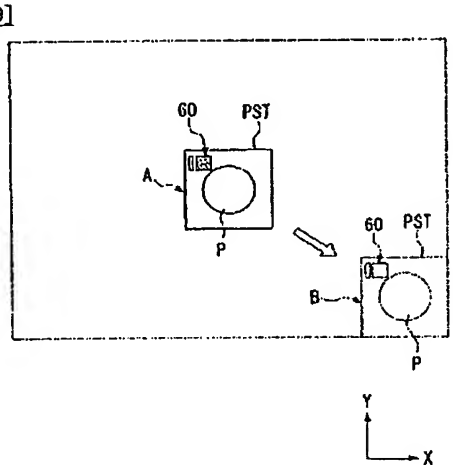
[Drawing 7]



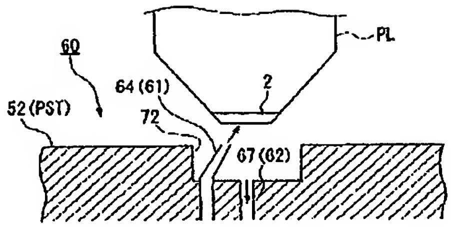
[Drawing 8]



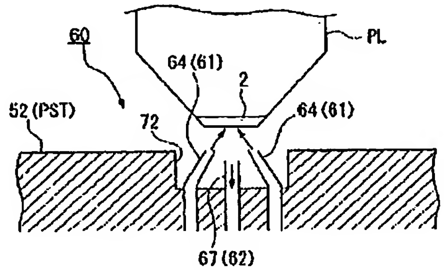
[Drawing 9]



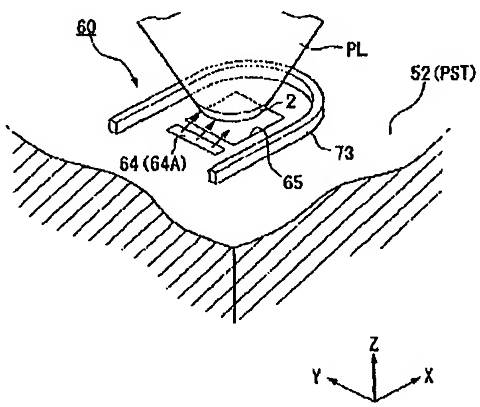
[Drawing 10]



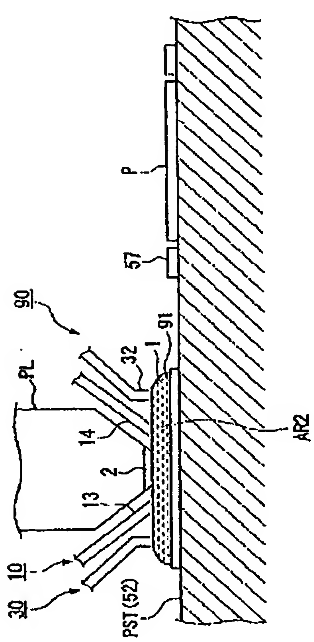
[Drawing 11]



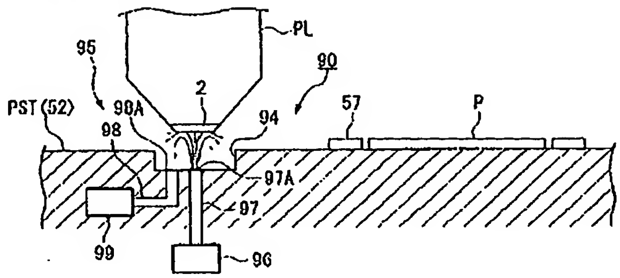
[Drawing 12]



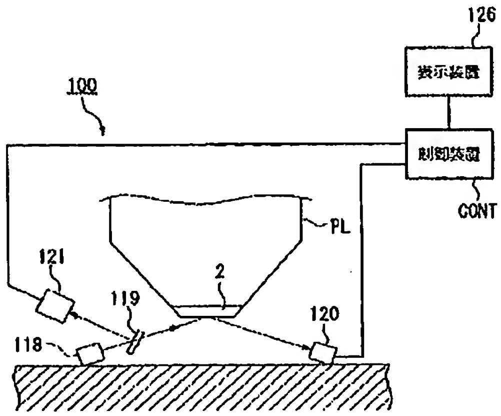
[Drawing 13]



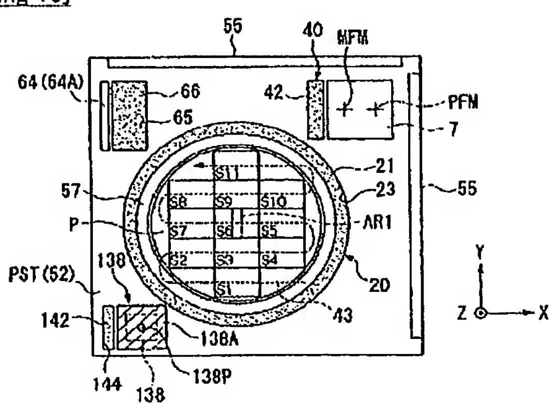
[Drawing 14]



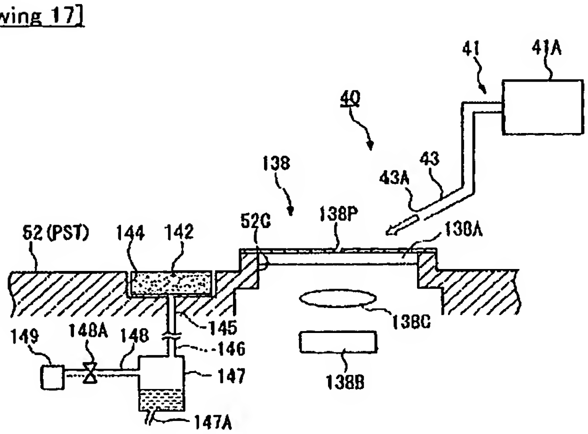
[Drawing 15]



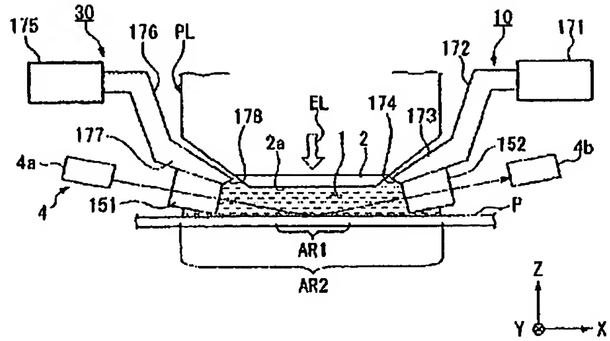
[Drawing 16]



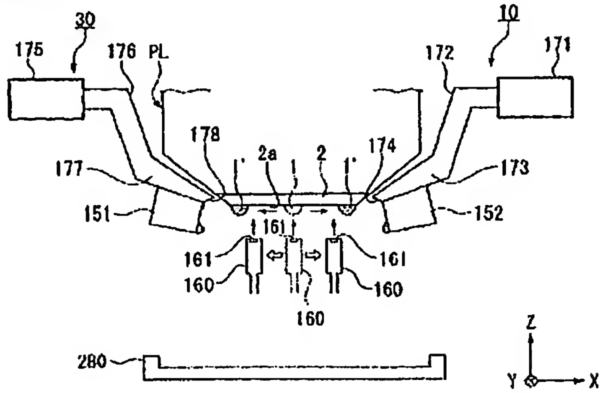
[Drawing 17]



[Drawing 18]

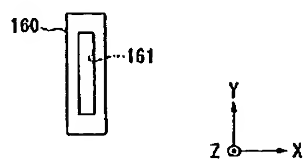


[Drawing 19]

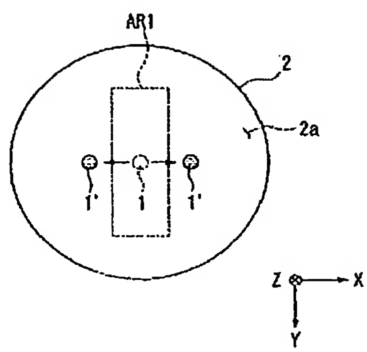


[Drawing 20]

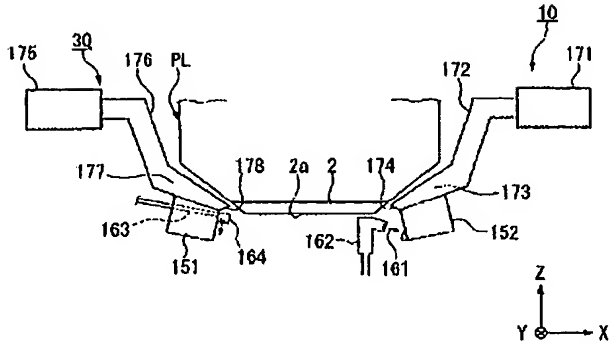
(a)



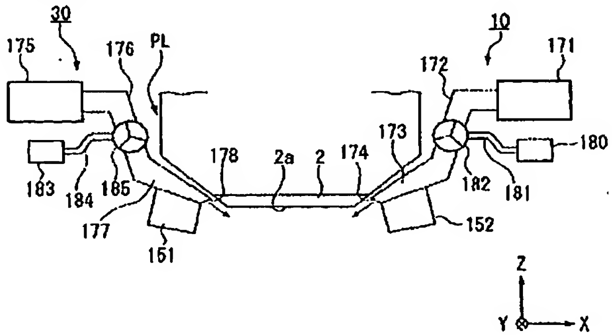
(b)



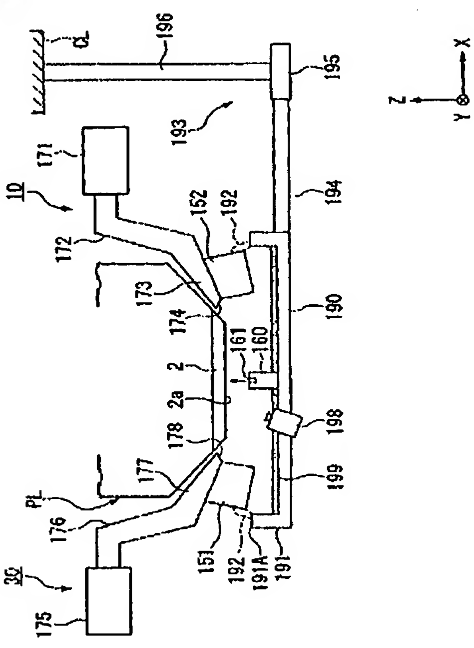
[Drawing 21]



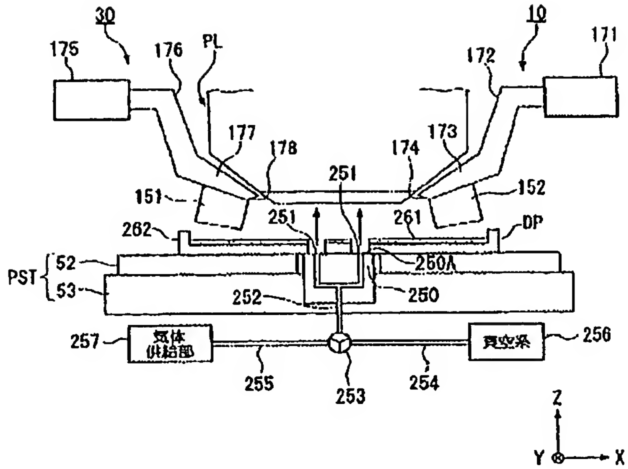
[Drawing 22]



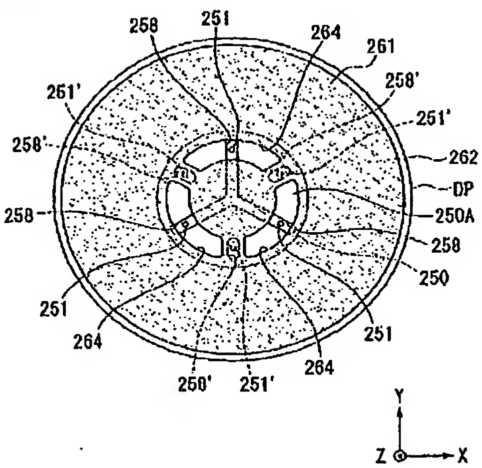
[Drawing 23]



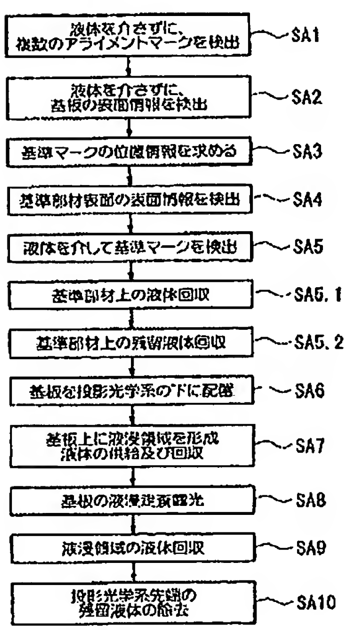
[Drawing 24]



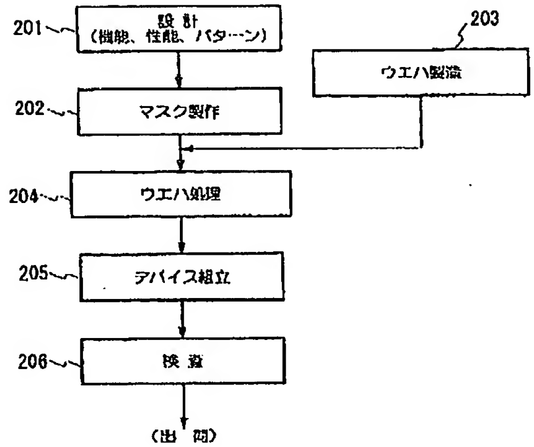
[Drawing 25]



[Drawing 26]



[Drawing 27]



[Translation done.]